FEE SCHEDULE FOR OVERWEIGHT VEHICLES IN MONTANA

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EXECUTIVE SUMMARY

A new damage based fee schedule is proposed herein for overweight vehicle traffic on Montana highways. The new schedule, which specifically addresses single trip movements of overweight vehicles carrying non-divisible loads, is designed to compensate the state for (a) the cost of administering the permit program and (b) the cost of the extraordinary (and unexpected) damage inflicted on the highway by the overload. These costs are to be recovered through a flat administration fee and a graduated fee related to the amount and distribution of the overload and the distance traveled. This schedule would replace the current overweight fee system, which simply assesses flat fees based on broad categories of distance traveled. The graduated damage fee in the proposed schedule is calculated as the product of a net damage cost per mile times the distance to be traveled (in miles). The net damage cost per mile is calculated as the product of the excess damage factor for the vehicle times a unit damage cost per mile. The excess damage factor for the vehicle is based on the amount the individual axle loads exceed the maximum unpermitted axle loads. A chart of excess damage factors was prepared for each major axle type (single, tandem, and tridem) in 1,000 pound increments of total axle load. The net damage factor for the vehicle is simply the sum of the damage factors for the individual axles.

The damage related portion of the proposed fee schedule was developed based on a study of the factors that influence pavement damage and the cost of such damage. For the purposes of this study, damage was defined as the general deterioration and loss of serviceability of the pavement with use and time. The pavement damage associated with the passage of a particular vehicle was expressed in terms of the relative life of the pavement consumed by the passage of that vehicle. Factors that influence the damage inflicted on a pavement by any given vehicle include various characteristics of both the vehicle and the pavement it traverses. In a review of these characteristics (e.g., axle load, tire width, tire pressure, subgrade conditions, pavement type, etc.), it was found that individual axle loads (not gross vehicle weight) have an overwhelming influence on pavement damage. In the interest of simplicity in applying the new schedule, axle load was the only parameter explicitly considered in the proposed fee structure. Relationships between total axle load, axle configuration, and pavement damage have been experimentally established. These relationships are usually expressed in terms of the number of passages of an 18,000 pound axle necessary to inflict the same pavement damage as a single passage of the axle in question (referred to as the number of equivalent single axle loads, or ESALs). Experimental results indicate, for example, that a single axle loaded at 24,000 pounds does three times as much pavement damage as the same axle loaded at 18,000 pounds. Single passage of the 24,000 pound axle is equivalent to three passages of an 18,000 pound axle with

respect to pavement damage. Thus, the 24,000 pound axle has an ESAL value of 3.0. Similar equivalencies have been established for tandem and tridem axle configurations.

These ESAL to axle load relationships can be used to determine the excess damage inflicted by each axle of an overweight vehicle. This damage is calculated as the difference between the total damage for any overweight axle and the damage which would be inflicted by the same axle operating at the maximum unpermitted load. The excess damage or damage factor for the entire vehicle can then be calculated as the sum of the excess damage (excess ESALS, for example) associated with each overweight axle.

A cost was assigned to the excess pavement damage resulting from overweight vehicles using information available for recent highway projects in Montana. An average project cost was divided by an average design life (expressed in total number of equivalent single axle passages, or ESALs) to obtain a unit pavement cost (e.g., expressed in dollars/ESAL/mile). A percentage of this cost (60 or 80 percent, depending on traffic volume) was attributed directly to vehicular use (damage) of the highway; the remaining damage was attributed to adverse environmental conditions and aging of the pavement. Following this approach, a cost of $0.16/ESAL/mile was obtained for primary and interstate highways in Montana. This unit pavement cost is then multiplied by the net damage factor for a vehicle (expressed in ESALs), and the distance traveled, to obtain the damage related portion of the permit fee. This approach to calculating pavement costs may seem simplistic, in that pavement construction costs are actually influenced by many factors, such as the pavement maintenance strategy employed by the state, available funds, and other economic, social, and political issues. The key is that although this is a rudimentary approach, it is appropriate and adequate based on the uncertainties associated with many of these factors.

The form of the proposed fee schedule is reasonable with respect to the overweight fee practices in other states. A survey of these practices nationwide indicated little uniformity in overweight fee schedules between the states. Schedules range in complexity a simple flat fee to a complex system that considers, individually or collectively, factors such as axle weights, gross vehicle weight, type of highway, and distance traveled in arriving at a permit fee. Wyoming, for example, utilizes all these factors in assessing permit fees. Several states in addition to Wyoming, in the Northwest and West, use some form of weight per mile charge in assessing overweight vehicle fees.

Based on a limited sampling of typical overweight situations in Montana, the new schedule, if implemented, will result in a net increase in overweight permit fees. On an individual basis, some vehicles may pay a lower fee using the new schedule than was assessed under the old schedule. The fee structure proposed herein is based on axle weight, rather than gross vehicle weight. An overweight vehicle with properly distributed axle loads, that inflicts little excess damage to the

pavement, will pay low permit fees. Thus, the proposed fee schedule rewards proper weighting of axles to minimize pavement damage. Such an incentive to load vehicles in a manner to limit pavement damage is absent in the fee structure currently used in Montana. Note that the proposed fee schedule may have to be modified to accommodate special circumstances in which the damaging effects of large axle loads are mitigated by other factors. Special consideration may be required for example, for heavy equipment with wide, large diameter tires that minimize tire-to-pavement contact pressures. Furthermore, while the proposed schedule addresses single axles, tandems, and tridems (common axle configurations), some vehicles are now equipped with quadrums (four closely spaced single axles). The damaging effects of this axle configuration need to be studied, and fee provisions developed as appropriate.

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The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the State of Montana, Department of Highways or the Federal Highway Administration.

INTRODUCTION

Background

Development of a rational fee schedule for permitted overweight vehicle travel on public highways is a challenging problem. Overweight vehicles, by definition, place a demand on pavements in excess of that originally anticipated in the highway design process. This increased demand results in accelerated deterioration of the pavement and an attendant decrease in its service life. Consequently, overweight vehicles have traditionally been assessed special user fees to account for the accelerated damage. The general approach has been to assess a fee proportionate to the expected excess pavement damage plus the cost of issuing the permit. The damage fee has two components, namely, the amount of excess damage inflicted per mile, and the number of miles to be traveled. The damage inflicted per mile is dependent on several factors, including, the vehicle axle weights, tire widths, and tire pressures, and the pavement condition, type, temperature, and subgrade. All these factors influence the damage sustained during overloading. The exact nature of the relationship between many of these parameters and pavement damage is not precisely understood. Furthermore, the cost of such damage can be difficult to quantify, since factors such as the choice of rehabilitation strategy, the time value of money, and the economic benefits of allowing overweight vehicle traffic come into play. Finally, in developing an overweight fee schedule, practical aspects of its administration must also be considered. The fees must be simple to understand, and easy and quick to calculate.

Presently, each state regulates overweight vehicle travel within its own borders, subject to the provisions of Federal law. A variety of overweight fee schedules are being used, and they consider some, or all, of the issues mentioned above. Montana presently charges "flat" fees for various categories of distance traveled, independent of the amount of overweight. While this present fee schedule is simple to administer, a more equitable system might consider at least the magnitude of the overweight as well as the distance traveled in arriving at a permit fee. This approach has been adopted in many states.

Objectives and Scope

The objective of this project was to develop a pavement damage based, graduated fee schedule for overweight vehicle travel on state highways in Montana that would replace the present system of simply assessing overweight fees based on broad categories of distance traveled. The project specifically targeted one-way trips involving non-divisible loads. The project began with a review of current practice in other states and of the present engineering knowledge regarding the

underlying factors that influence pavement damage caused by overweight vehicles. The repair and maintenance costs associated with this damage were also researched. The basic form of the proposed fee schedule for Montana was derived from this information. The selected form of the fee schedule represents a compromise between the requirements of technical rigor in the formulation and practical simplicity in its application. This schedule is based on the excess pavement damage associated with the passage of each overweight axle. (Note that extraordinary damage to bridges was not considered in the fee schedule.) The specific values presented in the schedule reflect the legal load limits, highway construction and maintenance costs, etc. particular to Montana. Example fee calculations for typical overweight vehicle configurations were done using the new schedule. These fees were compared with those charged in neighboring states for the same vehicle and with penalties which would be assessed in Montana for illegally moving the same loads. Recommendations were made with respect to possible future improvements in the fee schedule, notably with respect to increased equitability through computerization of the system.

PAVEMENT DAMAGE AND OVERWEIGHT VEHICLES

General Remarks

To assess the excess damage inflicted on a pavement by an overweight vehicle, it is necessary to first select an appropriate measure of pavement damage and then to research the basic factors that influence and contribute to this damage. For the purposes of this study, damage was defined as the general physical deterioration of the pavement with use and over time. The damage sustained due to vehicular use was of special interest in this study, and this damage was measured in terms of the decrease in useful life of the pavement associated with the passage of each vehicle. The damage sustained by a given pavement due to the passage of a single vehicle is affected by several factors related to both the vehicle and the pavement. Important characteristics of the vehicle include individual axle loads, axle configuration, tire configuration, tire size, and tire pressure. Pavement related parameters of interest include pavement type (e.g., asphalt or concrete), thickness, subgrade conditions, temperature, and present condition. Naturally, each factor contributes to the damage in varying degrees, and they have been listed approximately in their order of importance, with axle load and axle configuration overwhelmingly having the most effect on pavement damage. Based on the values of these various parameters, the damage sustained during passage of a single vehicle can be assigned a numerical value. If the vehicle is overweight, the damage can be divided into two parts, namely, the anticipated damage associated with the vehicle operating at the maximum unpermitted load, and the excess damage resulting from the overload. This excess damage, expressed in terms of the decrease in the useful life of the pavement, can be assigned an economic value by prorating it against the expected life of the pavement and the total cost of its construction/rehabilitation.

Axle Loads and Gross Vehicle Weight

The AASHO Road Test (Highway Research Board (HRB), 1962) and other studies (e.g., Wang, 1982) have demonstrated that pavement sustains rutting and fatigue damage under traffic loads. The fatigue damage can be generally related to the horizontal tension stresses generated at the base of the pavement under repeated loads (Bonaquist, et.al., 1989). Rutting, primarily a problem in flexible pavements (such as asphalt), can be generally related to the vertical compressive stresses generated at the top of the crushed aggregate base (Bonaquist, et.al., 1989) and densification and lateral creep of the pavement material (Oteng-Seifah and Manke, 1976). In the damage process, passage of each axle or axle group (e.g., tandems or tridems) making up a vehicle constitutes a load application. Thus, damage accumulated by each vehicle passage is related to the magnitude and number of its axle loads, rather than simply its gross weight. At low axle load levels, the damage

inflicted during any given passage may be imperceptible, and the deterioration becomes evident only after the accumulation of many load cycles. At higher axle loads, more damage is inflicted by each passage, and pavement failure could occur after the passage of only a few such axles. At the extreme, passage of a single sufficiently heavy axle could result in immediate pavement failure. Thus, each axle passage consumes some of the pavement life, presuming this life is expressed in terms of some finite number of load applications after which the pavement becomes unserviceable.

Relationships between reduction in pavement serviceability and magnitude and cycles of axle loading were experimentally established in the AASHO Road Test, and they have been validated in subsequent research efforts. In part of the AASHO Road Test, sections of pavement were loaded with repeated cycles of the same axle load until a predetermined level of deterioration was reached. This deterioration, or residual serviceability, was assessed using the Present Serviceability Index (PSI), which was calculated from measurements of the pavement surface profile; observations of rutting and cracking; and consideration of any patching performed (HRB, 1962). This index, developed from input from pavement specialists, was specifically formulated to provide a general indication of a pavement's ability to serve traffic. The index ranges from 1 to 5, with a value of 5 corresponding to a pavement in excellent condition. Pavements with a PSI of 2.0 and 2.5 for primary and interstate highways, respectively, would be considered in need of immediate repair, and a pavement with a PSI of 3.0 would be considered in need of repair in the near future (TRB, 1990b). The results of the AASHO Road Test were presented in terms of the cycles of axle loading at a given weight level necessary to reduce a given pavement to a certain PSI. Loads considered in the tests ranged from 2 to 30 kips and 24 to 48 kips acting on single axles and tandems, respectively.

The results of the AASHO Road Test have been used to determine the relative damage sustained by pavement under different axle loads. Relative damage was expressed with respect to the damage inflicted on the pavement by the passage of a single axle carrying 18,000 pounds (18,000 pounds was the legal axle load limit in several states at the time of the AASHO Road Test, (Connor, 1980)). A typical plot of the resulting relative damage or damage factor as a function of axle load is presented in Figure 1.

The damage factors presented in Figure 1 are referred to as equivalent single axle loads (ESAL), and they indicate the number of 18,000 pound axle loads required to damage the pavement equivalent to a single passage of the axle load in question. For example, referring to Figure 1, a single axle loaded at 20,000 pounds (the legal limit specified in the Montana Code Annotated (M.C.A. 61-10-107, 1989) has a damage factor or ESAL of 1.49 on flexible pavement. Single passage of this axle does 1.49 times as much damage as passage of an axle loaded at 18,000 pounds.

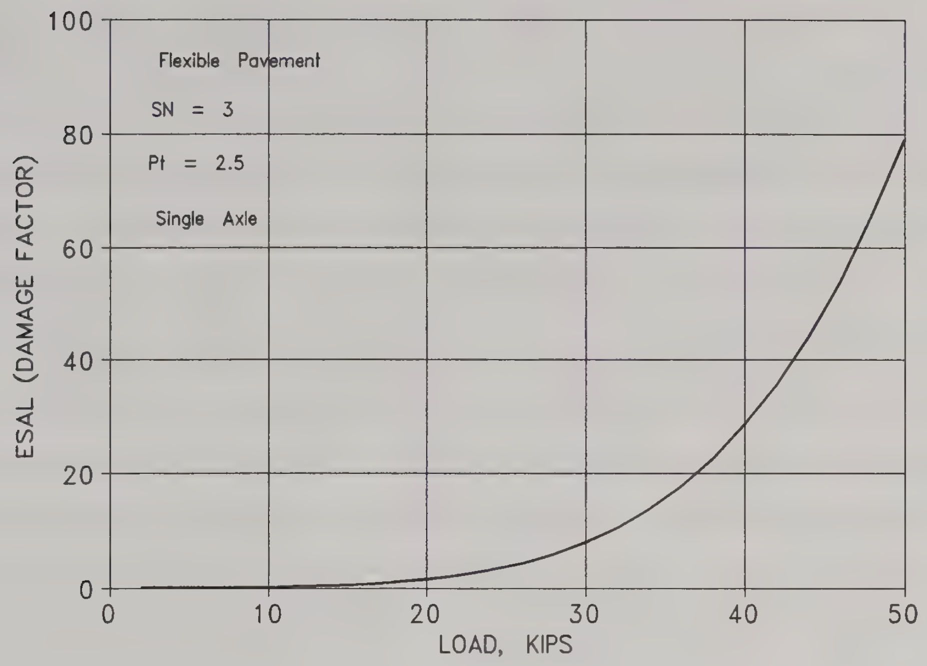


Figure 1. Typical ESAL to axle load relationship.

The relationship between damage factor and axle load is non-linear. That is, as the load increases, the damage factor increases exponentially. Curves fitted to this data indicate a fourth order relationship between damage factor (relative damage potential) and axle weight. A single axle load of 26,000 pounds has an ESAL of approximately 4.31 for flexible pavement. Thus, loading this single axle with just 30 percent more weight (26,000 versus 20,000 pounds) results in almost three times as much pavement damage (4.31 versus 1.49 ESALS). An automobile axle carrying 2,000 pounds of weight has an ESAL of only 0.0003. Thus, it would require around 5,000 passages of an automobile axle to inflict as much damage on the pavement as passage of single axle loaded at 20,000 pounds (ratio of 1.49/0.0003).

In the case of non-divisible loads, one measure of the excess damage associated with an overweight axle is the difference between the actual ESAL for the axle and the ESAL for the axle at the maximum unpermitted load. This approach presumes a certain volume of traffic was planned for at all unpermitted load levels in the design process, so the unexpected or extraordinary damage is simply associated with the overweight. By definition, it is impossible to split non-divisible loads and transport the parts within unpermitted weight limits. Thus, it is unnecessary to adjust the damage due to the overload to account for the damage that would be sustained by the pavement if the overload

was separated and transported in several lesser (and legally unpermitted) loads.

Different ESAL to axle load relationships were developed from the AASHO test data for single and tandem axles. The results of the AASHO Road Test indicate that pavement damage decreases when the applied load is carried on closely spaced axles compared to widely spaced axles. Deacon (1990) attributed this decrease in damage for grouped versus single axles to, among other things, favorable interference in the stress patterns generated by the individual axles in the group. Due to this effect, the definition of discreet axles and axle groups is important in properly applying the ESAL approach to damage. Conceptually, axles can be considered in a group if they are spaced sufficiently close that their zones of influence (on the pavement) overlap. The theoretical limit at which axles act independently is approximately 120 inches (Deacon, 1988). The tandem axles used in the AASHO Road Test were spaced around 50 inches apart. Thus, the results of the AASHO Road Tests provide equivalency factors for spacings that are greater than 120 inches (single axle results) and approximately 50 inches (tandem axle results). Typical ESAL relationships developed from the road test data for these two cases are shown in Figure 2.

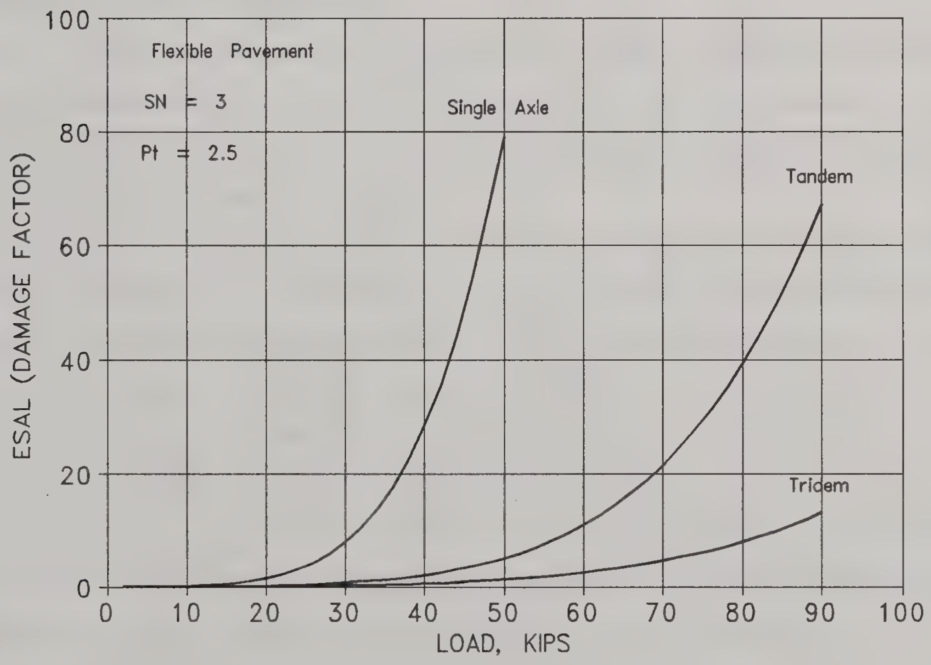


Figure 2. Typical ESAL to axle load relationships, single axles, tandems, tridems.

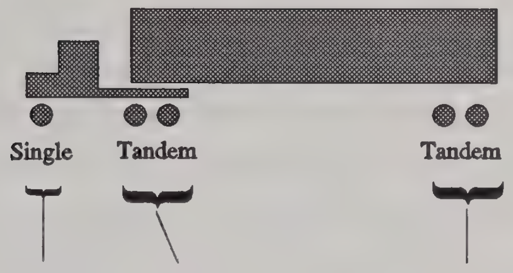
The ESAL to axle load relationships developed by AASHTO can be used to illustrate the significance of axle spacing on pavement damage. Referring to Figure 2, a 36,000 pound load carried on two single axles spaced at 50 inches (a tandem axle) has an ESAL of 1.38. This same load of 36,000 pounds carried on two single axles spaced at 120 inches has an ESAL of 2.0 (1.0 for each axle acting singly). Thus, a relatively small increase in absolute axle spacing resulted in a 45 percent increase in pavement damage. Based on these observations, the commonly defined tandem axle consisting of two axles spaced 40 to 96 inches apart (TRB, 1990b), embraces a wide range of pavement damage potentials (ESAL values). This tandem axle definition is the statutory definition of tandems in Montana (61-10-107, M.C.A., 1989).

ESAL to axle load relationships for tridems were analytically developed, as tridems were not included in the AASHO Road Test. One such relationship is shown in Figure 2 with the single axle and tandem relationships. Montana does not presently have a statutory tridem definition. A reasonable definition for a tridem is any three axles each spaced 40 to 96 inches from the next axle in the group (TRB, 1990b). Some vehicles are now equipped with quadrums, which are axle groups consisting of four closely spaced single axles. Information is presently being collected on the limited research that has been done on the damaging effects of quadrums. Evidence also exists that steering axles are more damaging than non-steering axles. Specific ESAL to axle load relationships, however, have not been developed for steering axles.

The net ESAL or damage factor for a vehicle is simply the sum of the ESALs for the individual axles or axle groups for the vehicle. A typical ESAL value for a common tractor trailer configuration (labeled 3S2) loaded at the maximum unpermitted load allowed in Montana of 80 k (80,000 pounds) is 2.45, as illustrated in Figure 3.

The approach to pavement damage described herein assumes that damage accumulation is independent of the order of the load cycles. That is, a given axle load does the same damage to the pavement early in the pavement life as well as later in life. Evidence exists, however, that once a certain level of deterioration is achieved, damage occurs at an increasing rate. Referring to the AASHO Road Test results, it appears this acceleration may occur at a present serviceability index of 2.5 to 3.0. The AASHTO approach to pavement design (AASHTO, 1986) apparently recognizes this situation, in that the approach utilizes different ESAL factors for different allowable levels of terminal serviceability (Pt) in the pavement. That is, for example, if a pavement design is based on an allowable deterioration to a PSI of 3.0, a 20 kip single axle load has an ESAL of 1.41. If this same pavement is designed to a terminal PSI of 2.0, a 20 kip single axle load has an ESAL of 1.56. This difference may be attributable to the fact that as the pavement deteriorates, a 20 kip axle load does increasing damage and uses up more of the pavement life. This trend is generally observed in both

TYPICAL 3S2 TRUCK
LOADED AT 80 k (80000 lbs)



AXLE LOADS	12 k	34 k	34 k
ESALs/AXLE	0.23	1.11	1.11

ESAL values from Fig. 2, selected based on load and axle type

TOTAL ESALS (DAMAGE FACTOR) = 0.23 + 1.11 + 1.11 = 2.45

Figure 3. Calculation of net ESALs for a typical truck loaded at the maximum unpermitted load of 80k.

flexible and rigid pavements, and for all axle types.

At some level of axle load, the pavement will sustain sufficient damage during a single passage of the axle that its subsequent life will be significantly reduced. This situation can be guarded against by establishing absolute maximum axle loads that even permitted vehicles may not exceed (without extraordinary permission of highway authorities). Such absolute maximum loads can be reasonably, although indirectly, established based on the AASHTO ESAL to axle load relationships. Referring to the specific relationship for single axles presented in Figure 2, the ESALs (a) increase gradually with axle load up to a value of approximately 27 kips and (b) climb dramatically at axle loads above approximately 37 kips. To avoid the excessive ESAL values in the latter load regime, it would be reasonable to limit the maximum allowable single axle load, even in overweight situations, to a value between 27 and 37 kips. A reasonable upper load limit would perhaps be the central value within this range of 32 kips, which corresponds to an ESAL of 10. The ESAL relationships for tandems and tridems (also presented in Figure 2) do not exhibit the dramatic rise in ESALs at higher load levels that is observed in the single axle case. One approach to establishing maximum load limits for these axle configurations is to set the same maximum allowable ESAL on these axles as that established

for a single axle. Thus, the maximum loads allowed on tandems and tridems would be 60 kips and 84 kips, respectively, corresponding to a maximum ESAL of 10.

Tire Configuration and Inflation Pressure

The damage sustained by pavement under a given axle load is influenced by the specific manner in which that load is transferred to the pavement through the tires. Parameters of concern with respect to tires include number (e.g., single or dual), size (i.e., width), and inflation pressure. These parameters may influence both the rutting and fatigue performance of the pavement (Deacon, 1988). Many investigators have researched the effect of single versus dual tires on pavement damage (e.g., Deacon, 1988; Hallin, Sharma, and Mahoney, 1983). Deacon reported on several such studies, and in all cases, as the single tire width decreased, the damageability increased. The relative damage inflicted by single tires compared to dual tires ranged from 192 percent for a 10 inch wide tire on a 3 inch thick flexible pavement to 110 percent for an 18 inch wide tire on a 9 inch thick rigid pavement. General load equivalency factors to account for single tire width (with respect to a standard dual tires, 10.00x20/12) developed by Scala and Porter (1981) for all pavements and as reported by Deacon are presented in Table 1. These factors range from 1.5 for 10 inch wide tires to 1.2 for 18 inch wide tires. The results of this and other studies might be criticized as overestimating the beneficial effects of dual versus single tires. These studies generally presume or encourage balanced load sharing between the tires forming the dual tire, while in actual practice, due to uneven tire pressures and tread wear, a significant imbalance in the shared load may occur. Any such imbalance results in increased pavement damage for the tandem axle. Note that the excessively wide single (balloon) tires used on some heavy equipment could possibly decrease pavement damage, and such tires may require special consideration in evaluating pavement damage.

Table 1. Damage factors for various single tire vs. dual tire configurations (from Scala and Potter, 1981, as reported by Deacon, 1988).

Single Tire Width	10	12	14	16	18
Conversion Factor to Equivalent Standard Dual Tires	1.50	1.41	1.33	1.26	1.20

Standard Dual Tires - 10.00x20/12 at 70 psi

Bonaquist and his colleagues (1989) found that tire inflation pressure has only limited influence on the damage inflicted on flexible pavement by a given tire. Concern centered on the idea

that an increase in tire inflation pressure resulted in a decrease in the effective contact area between the tire and the pavement. This decrease in contact area could result in an attendant increase in contact stress that could conceivably lead to accelerated fatigue and rutting damage (TRB, 1990). Such concerns were certainly justified, in that several studies reported by TRB (1990) indicated truck tire inflation pressures averaged around 100 pounds per square inch, an increase of 20 to 30 percent over the average pressures (75 and 80 psi) used in the AASHO Road Test. One such study for example, performed in Montana (MDOH, 1984) and reported by TRB (1990), found an average pressure of 101 psi over a sampling of 2,365 trucks. An experimental study conducted by Bonaquist and his colleagues, however, showed that an inflation pressure of approximately 100 psi caused only 10 percent more damage to flexible pavement then a pressure of 80 psi. The maximum inflation pressure considered in the study was 140 psi, at which an increase in damage of 30 percent was observed. Analyses conducted by Marshek and his colleagues (1986) imply that damage in rigid pavements is minimally influenced by tire pressure.

Temperature

Temperature at the time of loading has a greater effect on flexible pavement damage than tire inflation pressure (Bonaquist, Surdahl, and Mogawer, 1989). Notably, rutting damage has been linked to pavement temperature. In a study conducted in a warm climate, rutting occurred 5 times faster during a season with a central temperature of 95 deg F compared to a season with a central temperature of 60 deg F (Bissada and Al-Sanad, 1985). Rutting damage was attributed to excessive deformations in both the pavement and subgrade materials. Imposition of seasonal load limits based on temperature was recommended to reduce rutting damage.

Pavement and Subgrade Configuration

The amount of damage sustained by a pavement under the passage of a particular axle load is directly dependent on the type of pavement, its thickness, and the subgrade conditions. In the case of flexible pavements, various combinations of materials, thicknesses, and subgrade conditions can be collectively evaluated using the structural number (SN) (AASHTO, 1986). Values for SN range between 1 and 6, with a value of 6 corresponding to the strongest/best flexible pavement. A cross-section of a typical pavement with an SN of 3 is presented in Figure 4. The influence of pavement type (as represented by structural number) on its damageability can clearly be seen by comparing the relationship between ESAL and axle load level for pavements with different SN values. Such a comparison is presented in Figure 5 for SN values of 1, 3, and 5. At low load levels (approximately 25 kips or less on a single axle), the ESAL factors are similar for all three SN values. At high load

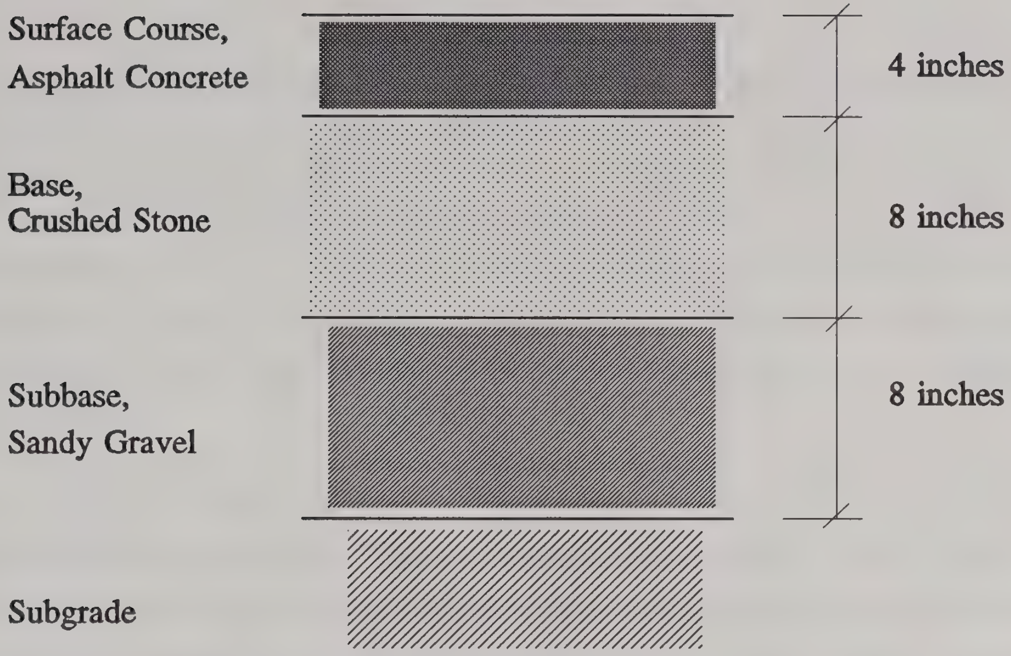


Figure 4. Typical flexible pavement with an SN of 3.

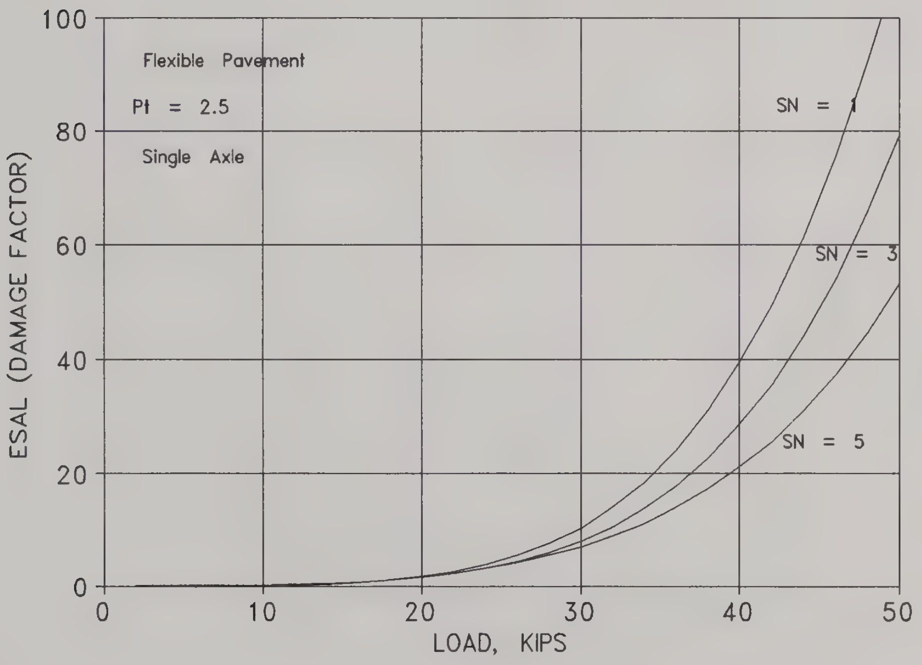


Figure 5. Change in ESAL to axle load relationship for different pavement and subgrade conditions (SN), flexible pavement.

levels, the ESAL factors decrease as the SN number increases. At a load of 32,000 pounds, for example, a 33 percent decrease in the ESAL factor is observed as the SN increases from 1 to 5. This trend is also observed in tandems and tridems (not shown in Figure 5). That is, the damage factors for tandems and tridems are similar for pavements with different SN values up to load levels of approximately 40 kips and 60 kips, respectively. At higher load levels, the damage factors decrease as the SN number increases. The damageability of rigid pavements is influenced to a limited extent by their thickness. Typical ESAL functions for pavement thicknesses of 6, 8, and 10 inches are presented in Figure 6.

The ESAL to axle load relationships for "average" flexible (SN = 3) and rigid pavements (t = 8 inches) are similar for single axle loads, but they increasingly diverge at higher loads on tandems and tridems, as illustrated in Figure 7. Tandems and tridems inflict significantly more damage on a rigid pavement than on a flexible pavement at load levels greater than approximately 30 and 40 kips, respectively. The damage factors for rigid pavements are 60 to 100 percent higher than those for flexible pavements in this load regime, which covers the load levels expected in overweight situations.

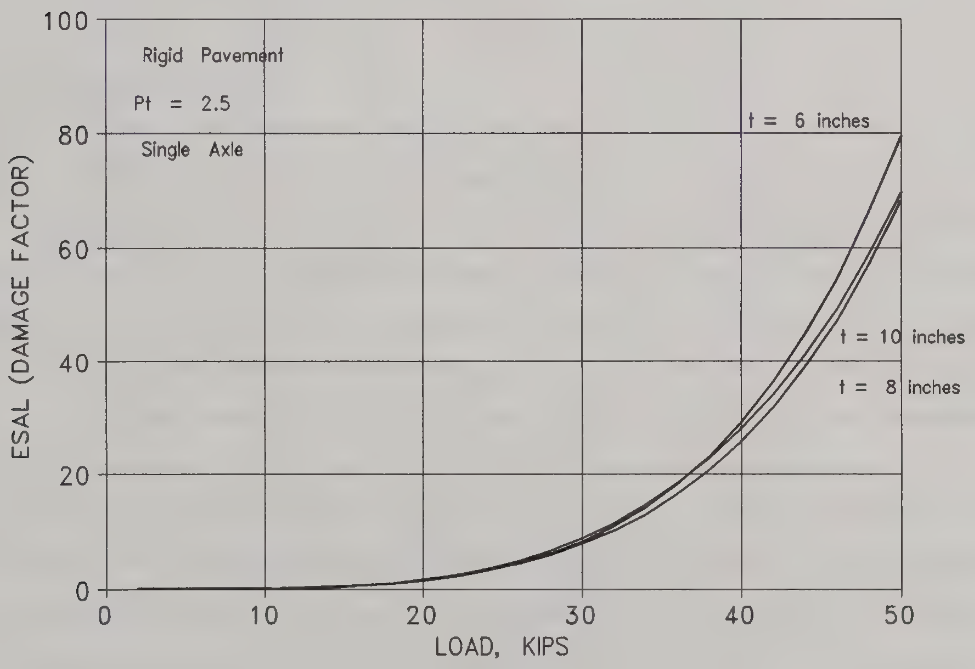


Figure 6. Change in ESAL to axle load relationship for different thicknesses of rigid pavement.

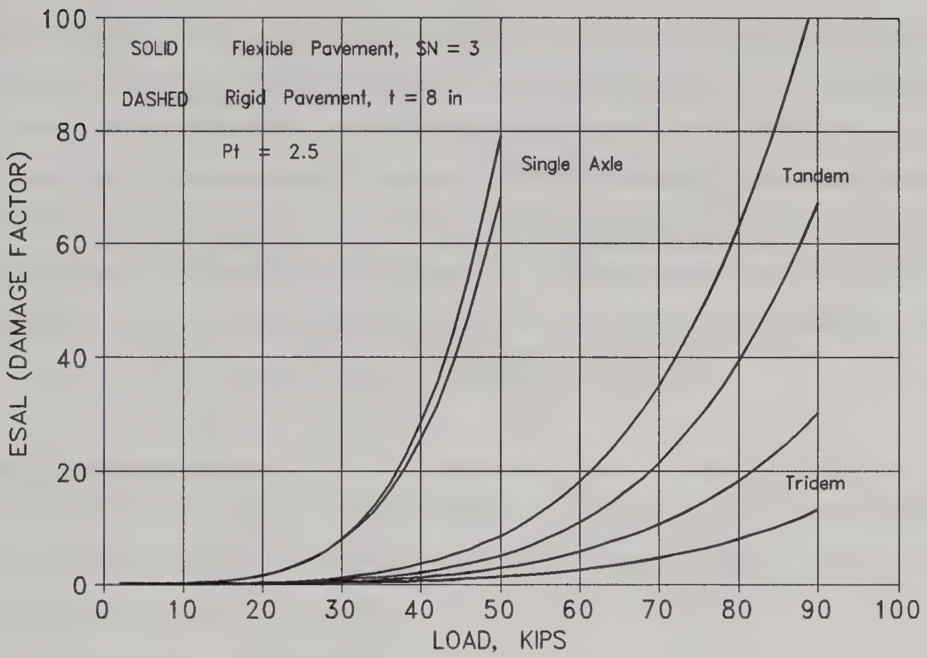


Figure 7. Comparison of ESAL to axle load relationships for flexible (SN=3) and rigid (thickness of 8 inches) pavements.

Environmental/Aging Effects

While pavement will deteriorate due to adverse environmental conditions and aging independent of vehicle loads, the contribution of such factors to the over-all deterioration process is often less significant than that of axle/vehicle loads. In a fairly broad investigation conducted by Hudson and Flanagan (1987), the deterioration of sets of identical trafficked and untrafficked sections of pavement were studied at 14 different locations across the United States. In all cases, the trafficked pavement sections exhibited more damage than the untrafficked sections, and generally, the difference in observed damage was dramatic. The damaging effect of traffic was proportionally higher in harsh environments (Minnesota) relative to mild environments (Texas).

While Hudson and Flanagan did not specifically quantify the proportion of pavement damage inflicted by traffic versus that attributable to weathering and aging, work of other investigators indicates that environmental and aging factors are responsible on the average for 20 percent of the observed deterioration in pavements. The damage attributed to environmental and aging factors ranged from approximately 8 to 50 percent of total pavement damage in various studies reviewed by the Oregon Department of Transportation (1986). In these studies, the relative magnitude of environmental and aging damage was influenced by specific climatic conditions, the type of pavement,

and the volume and type of traffic. Generally, as the volume of traffic (e.g., expressed in ESALS per day) decreases, the proportion of the pavement damage attributable to environmental factors increases. Note that adequate and relatively inexpensive surface maintenance (e.g., sealing) can potentially retard such deterioration in pavements. Thus, for example, in assessing environmental versus traffic related pavement costs, Georgia and Florida distinguish between surface (sealing) maintenance and roadway rehabilitation (resurfacing). In these states, environmental and aging factors are assumed responsible for approximately 80 percent of "surface" damage (repaired by sealing) and 25 percent of pavement damage (repaired by resurfacing).

Comprehensive Damage Models

Models have been proposed that simultaneously consider several of the aforementioned affects in arriving at a damage factor or "damaging power" of a given vehicle. Deacon, for example, worked on a damage expression of the form,

$$D = sum(di)$$

in which D is the total damageability for the vehicle and di is the damageability of each axle. The damageability of each axle was further calculated as,

$$di = (Pe/Po)**a$$

where Pe is the equivalent standard total load for the axle under consideration divided by a reference load, Po (e.g., 18000 pounds). The equivalent standard load for an axle is calculated as the product of the actual load on the axle and various factors as appropriate to account for differences between the actual and standard axle configuration. Deacon recommended the inclusion of factors for axle type, interaxle spacing, wheel type, tire pressure, and suspension type. Presuming values for these factors were available, and the exponent "a" could be determined, such an expression could be used to rigorously calculate the relative damageability of a given vehicle traveling on a particular highway. Insufficient information presently exists, however, to establish reliable values for all these factors.

Cost Analyses

Determination of the cost of long term pavement damage is a complex problem. This cost is integrally related to the pavement management strategy employed in constructing and maintaining the state transportation system. These management strategies are rationally developed to optimize resource use in operating the highway system, and they should lead to a degree of uniformity in highway costs. Often, however, these strategies must be modified in response to political, social, economic and other demands. These modifications can result in dramatic variations in effective pavement costs. Naturally, in computing life cycle costs of various paving options, the time value of

money can also be a significant (and a difficult to predict) factor. Recognizing the myriad of uncertainties involved in such complex calculations, it may be appropriate and adequate to estimate such costs using simple procedures.

One approach to establishing an average cost of pavement damage is to simply consider highway costs for some period of time versus the estimated use over that same interval. Such an approach was used by Middleton and his colleagues (1988), for example, in developing a proposed overweight fee schedule for the state of Texas. ESAL use for typical highway sections over a 20 year period were estimated from available data. Use was expressed in terms of actual total ESALs experienced with overweight trucks, and the equivalent ESALs experienced with all overweight trucks converted to lower normal weight loads. Maintenance and rehabilitation costs associated with each scenario were estimated. An 8 percent increase in maintenance costs was observed in the overweight case versus the non-overweight case. The statewide cost of overweight vehicle traffic was then calculated as 8 percent of the rehabilitation and maintenance costs for one year. This cost was then prorated against the estimated overweight vehicle traffic for the year (projected from permit operations and weigh station data). Euritt (1987) presents a similar cost analyses reportedly performed in an earlier Texas study (Walton and Yu, 1983).

Luhr and Fernando (1987) present an approach for assigning pavement damage cost to individual vehicles based on some cost for the pavement and the fraction of the pavement life consumed by the vehicle during its passage. The fraction of the pavement life consumed by the vehicle is related to the weight of its various axles, where this relationship is similar to that embodied in the AASHTO ESAL factors. Luhr and Fernando present an example in which rehabilitation costs for a certain roadway are assumed at $50,000/lane mile. The cost of the damage inflicted on the roadway by a vehicle that consumes 0.0003 percent of the life of the pavement in one passage is then,

$$\$50{,}000 * \frac{(0.0003)}{100} = \$0.15/\text{mile}$$

Luhr and Fernando comment that both initial and rehabilitation costs should be considered in determining the pavement costs used in this approach.

The damage/cost relationship postulated by Luhr and Fernando (1987) can be modified and used in conjunction with AASHTO ESAL factors to calculate an approximate cost of pavement damage inflicted by any vehicle on Montana highways. Assuming that

(a) highways (either new construction or rehabilitation projects) are designed to carry a certain volume of traffic, expressed in ESALs,

(b) the total costs of recent highway projects are known, and

(c) the percentages of pavement damage assignable to traffic and environmental sources are known or are assumed,

the cost per design ESAL mile for a given highway can be simply obtained by dividing the cost of the project (per mile) by the design ESALs. The subsequent cost of the damage sustained by the highway by the passage of a single vehicle is the cost per ESAL per mile multiplied by total ESALS for the vehicle, the distance to be traveled, and the percentage of the total pavement damage assignable to traffic/load related factors (to account for environmental versus traffic related damage).

Following the above described approach, the average cost of pavement damage in Montana due to traffic is $0.16/ESAL/mile. This cost is based on information provided by MDOH on actual highway costs and ESAL usage (Garber, 1990), and it represents average values for all the various segments of primary and interstate highway in the state. The cost of primary highways was calculated using an initial reconstruction cost for a typical two lane highway of $630,000 per mile and a cost of $170,000 per mile for any subsequent overlays. It was further assumed in this analysis that the highway would be overlayed twice (at twenty year intervals) before reconstruction was necessary. Thus, the cost of this highway over its useable 60 year life, independent of the time-value of money, was $970,000 ($630,000 + 2 x ($170,000)). Based on statewide data, the total amount of traffic expected on a typical primary highway over its useful life is 3,600,000 ESALs. This figure is based on an average traffic usage of 160 ESALs per day (this is the projected traffic volume in ten years, based on actual use in 1989) over a sixty year period. This is a relatively low volume of traffic, and, therefore, traffic loads were assumed to be responsible for only 60 percent of the pavement damage (the remaining 40 percent of the damage was assigned to environmental/aging processes). Based on these assumptions, the cost of traffic related pavement damage was found to be $0.162/ESAL/mile,

$$\frac{\$\ 970{,}000/\text{mile}}{3{,}600{,}000\ \text{ESALS}} \times 0.60 = \$0.162/\text{ESAL/mile}$$

A similar calculation was performed for the interstate highway system using a 2 lane reconstruction cost of $795,000/mile and an overlay cost of $203,000. Assuming the roadway is overlayed twice (at 12 year intervals) before reconstruction is necessary, the cost of the 2 lanes over the useable life of the roadway is $1,200,000 (795,000 + (2 x 203,000)). The total amount of traffic expected over the 36 year useable life of the roadway was estimated at 6,000,000 ESALs, based on an average daily usage of 470 ESALs/day (projected traffic volume in 10 years, based on 1989 data). At this level of usage, traffic was assumed to be responsible for 80 percent of any observed pavement damage. Using

these values, the cost of the interstate highways was calculated to be $0.160/ESAL/mile. Thus, following this approach, both primary and interstate highways cost approximately $0.16/ESAL/mile. Passage of a fully loaded 3S2 truck, with a net ESAL factor of 2.45 (see Figure 3), for example, inflicts $0.39 of damage per mile of travel (2.45 ESALs x $0.16/ESAL/mile). Note that these analyses do not include any charge for routine highway maintenance (43 million dollars were spent by MDOH on routine highway maintenance in 1989 (Garber, 1990)), even though overweight vehicles are responsible for some of these costs. Insufficient information is available to accurately establish that portion of these costs directly attributable to overweight vehicle traffic.

Euritt (1987) proposed another approach to assigning costs to overweight vehicle operators in Texas based on road user taxes and fees. Euritt determined the average annual user fee for heavy trucks in Texas by simply dividing the total revenue associated with user fees and taxes by the total number of registered trucks. Using extrapolations from weight and user data, he then determined the average overload for Texas trucks and applied this load to the most commonly overloaded truck configuration. He then calculated the ESAL values for the overloaded and legally loaded trucks, to establish the relative damageability of the overweight truck. Finally, he multiplied the ESAL ratio ((ESAL max normal weight)/(ESAL avg. overweight)) times the average user fee to determine a user fee the overweight operator should have been charged. This approach does not necessarily recoup the cost of the pavement damage, but it does charge for this damage at a similar rate to that charged for normal weighting.

The approach of Euritt (1987) can be approximately applied to Montana highways. The annual fee for a fully loaded unpermitted 3S2 truck with a gross vehicle weight of 80,000 is $ 988 in Montana. (61-10-201, M.C.A., 1989). A typical ESAL for this truck at this load is 2.45, as previously established. If this vehicle travelled an average of 300 miles per week (at a full load) for 50 weeks each year on Montana highways, it would travel 15,000 miles per year (this value requires further research and justification). Thus, the vehicle was assessed a fee of $ 0.027/ESAL/mile (988/15000/2.45).

Conclusions

Axle load and configuration are the most significant factors that influence the amount of damage sustained by pavement under vehicle loads. Each axle passage is a load event for the pavement with respect to the accumulation of fatigue damage and rutting. Thus, axle loads are more significant than the gross vehicle load in assessing the damage potential of a vehicle. Furthermore, test data obtained during the AASHO road test indicate that pavement damage increases at an

increasing rate (fourth order relationship) as axle load increases. Doubling of an axle load, for example, will result in a factor of 16 increase in the pavement damage. The various influences of other factors, such as tire width, tire pressure, pavement configuration, etc., on pavement damage, are dwarfed with respect to that of axle load. The damage sustained by the pavement varied only 30 to 100 percent as these parameters varied across their respective ranges of "extreme" values.

Therefore, in determining the pavement damage related to overweight vehicles, it is essential to at least consider axle load. Relationships between damage (expressed in ESALs) and axle load developed from the results of the AASHO road test can be used to quantify the relative damage inflicted on pavements for various axle loads and types. The various factors that influence these relationships (e.g., pavement type, pavement configuration, and terminal serviceability) should be considered in selecting a particular set of relationships to be used in a fee schedule. Using such an ESAL to axle load relationship, the excess damage sustained by the pavement due to the overweight can be simply expressed as the difference between the ESALs for the axle under the actual load and the ESALs for an identical axle loaded at the maximum unpermitted load level.

The excess damage associated with any overload can be assigned a cost by multiplying the damage expressed in ESALs by a unit damage cost. This unit cost can be estimated as the ratio of an average project cost to an attendant average design life for recent pavement rehabilitation/construction projects. This unit cost is then modified (e.g., reduced by 20 or 40 percent) to account for damage caused by non-traffic related factors, such as adverse environmental conditions and aging. While this cost analysis approach is simplistic, more sophisticated techniques may rely on uncertain information in arriving at a cost figure. Actual pavement costs are influenced by social, political, and economic factors beyond the control of the designer and that may be independent of technically prudent pavement management and rehabilitation strategies.

OVERWEIGHT FEE SCHEDULES, CURRENT PRACTICE

General Remarks

The assessment of fees for overweight vehicle travel is currently done on a state-by-state basis. In developing a fee schedule for Montana, it was of interest to generally review the philosophies adopted by other states in formulating their fee schedules. The fee schedule currently used in Montana for non-divisible overweight travel is simply based on distance travelled. Nationwide, fee schedule formulations range from simple flat fees to complex proration systems based on axle weight and distance traveled with provisions related to tire pressure and ambient temperature. The fee schedules used by neighboring states were of particular interest, in that various aspects of the economies and transportation systems in these states are similar to those in Montana. Both the form and absolute costs presented in these schedules were of interest in this study.

Montana

The current overweight fee schedule in Montana does not address the issue of pavement damage or attempt to recover any of the costs associated with pavement damage. Present regulations attempt to control and limit the travel of overweight vehicles so that pavement damage is minimized. These regulations are presented in Sections 61-10-101 through 61-10-110 of the M.C.A. Situations requiring a permit are clearly defined in Section 61-10-107 of the M.C.A. The maximum allowed gross weight of an unpermitted vehicle is 80,000 pounds. With respect to permitted vehicles, a formula is presented in Section 61-10-107 to calculate the maximum gross weight allowed for such vehicles, presuming axle and tire load restrictions are not violated. (This formula is the federal bridge formula, and its intent is to insure safe passage of vehicles over bridges.) Vehicles with a gross vehicle weight exceeding 80,000 pounds will pay a $20 trip permit fee or $100 term permit fee. In Section 61-10-121, authority is given highway officials to issue permits for loads that exceed the allowable values given in Sections 61-10-107 and 61-10-110. Currently, to minimize pavement damage, such permits generally are only issued for non-divisible loads and on a single trip basis (Galt, 1990). Permits for divisible loads in excess of the limits specified in Section 61-10-107 of the M.C.A. are only issued in situations that involve highly unusual circumstances (in 1989, for example, only 14 such permits were issued).

Presuming an overweight vehicle is carrying a non-divisible load and bridge safety concerns are satisfied, a single trip permit is issued. In fiscal year 1990, 23,000 such permits were issued (Knuckles, 1990). The permit fees are charged based on mileage and consist of a charge of (a) $10 for distances to and including 100 miles; (b) $30 for distances from 101 to 199 miles; and (c) $50 for

distances over 200 miles traveled. Highway officials also charge for analyses performed in support of special permit requests. Typical permits are presented in Appendix B.

In summary, the current practice in Montana is to control overweight loads traveling in the state by regulations on axle loads and gross vehicle weight. If loads are in excess of standard and are non-divisible, provisions are provided for a permit.

Nationwide

Across the nation, a variety of fee schedules and permitting programs have been enacted by the states with respect to regulating overweight vehicle travel. These practices embody a variety of philosophies with respect to such traffic. In a recent review of these practices (Secretary of Transportation, 1990), the results of which are partially summarized in Table 2, only two practices stood out that were common to most states, namely,

1) The maximum unpermitted single axle, tandem, and gross vehicle weights are 20,000; 34,000; and 80,000 pounds; respectively. Most states rely on federal funding for highways, and receipt of this funding may be contingent upon adherence to these federally established load requirements.
2) Overweight loads are allowed with a permit, which may be simply and inexpensively obtained for loads up to a certain gross vehicle weight. Above this weight, special permit provisions are invoked.

Starting with these two premises, each state has established a unique permitting system, ranging in complexity from simple flat fees to complex weight and mileage charges designed to recoup pavement damage costs.

The least complicated permit system is typified by that of Nebraska. Nebraska uses the load limits stated above to delineate overweight situations. If a vehicle is overweight, the federal bridge formula is used to determine the maximum allowable load. Presuming the load conforms to the bridge formula, the fee for a single trip is simply $15. At the other extreme of complexity are overweight programs such as those used in Wyoming and Louisiana, in which fees are based on consideration of gross weight, axle weight, and distance traveled. The fees assessed by these more complicated systems go up proportionally, although there does seem to be an average upper maximum of around $200.00.

Table 2. Summary of overweight fee practices, nationwide, non-divisible loads.

State	Basis for Overweight Fee			
	Flat Admin. Charge	Axle Weight	Gross Vehicle Weight	Mileage
Montana				X
Idaho	X		X	X
Oregon	X			
Washington	X		X	X
Wyoming		X	X	X
Utah			X	X
South Dakota	X		X	X
North Dakota	X		X	
California	X			
Nevada	X			
Arizona	X			
Colorado	X		X	
New Mexico	X			
Alaska	X		X	
Nebraska	X			
Minnesota	X	X	X	X
Wisconsin			X	
Iowa	X			
Illinois		X	X	X
Indiana	X		X	X
Michigan	X			
Ohio	X			

Maine		X		
Vermont	X			
New Hampshire			X	
Massachusetts	X	X		X
Connecticut	X			
Delaware	X		X	
Maryland	X		X	
New Jersey	X		X	
New York	X		X	X
Pennsylvania	X		X	X
Rhode Island	X			
Kansas	X			
Oklahoma	X		X	
Arkansas	X		X	X
Kentucky	X		X	
Tennessee	X		X	X
Missouri	X		X	X
Virginia	X		X	X
West Virginia	X		X	X
North Carolina	X			
South Carolina	X			
Georgia	X			
Alabama			X	
Mississippi			X	X
Louisiana		X	X	X
Texas	X			
Florida			X	X

Table prepared from information presented by the Secretary of Transportation (1990) for Fiscal Year 1988.

Although all states follow the federal guideline of 80,000 pounds for a maximum non-permitted gross vehicle weight, the maximum permitted gross vehicle weights vary. Simple and inexpensive permits are often available up to gross vehicle weights of approximately 100,000 pounds, presuming the vehicle is in conformance with the federal bridge formula and maximum axle loads. In general, however, there is no consensus as to what, if any, excess weight should be allowed. Some states have provisions for heavyweights, or loads significantly in excess of unpermitted load limits. In North Dakota, for example, overweights in excess of 105,500 pounds but less than 200,000 pounds are heavyweights, and are subject to a special fee schedule. To move loads in excess of 200,000 pounds requires specific permission of the North Dakota Department of Transportation. The state of Michigan seems to have the highest allowable permitted weight of 154,000 pounds (TRB, 1980). Several states indicate that if some maximum gross vehicle weight is exceeded, the transportation department must be contacted for a special permit. Idaho specifically states that a minimum fee of $100 will be paid to the Engineering Department of the Department of Transportation to consider special permit requests for overloads in excess of maximum established limits, with the possibility of additional fees being assessed based on the analyses.

Several states have seasonal load restrictions to control overweight traffic during periods when pavements are especially susceptible to damage due to environmental considerations (e.g., spring thaw, warm weather, etc.). North Dakota, for example, does not allow overweight vehicles to travel over flexible pavements when the ambient temperature exceeds 85 degrees F.

Northwest Region

The features of the overweight fee schedules used by states in the northwest region are summarized in Table 3. In general, states in the northwest region follow the basic federal load requirements which consist of 20,000 pounds on a single axle, 34,000 pounds on a tandem axle, and an 80,000 pound gross vehicle weight. Furthermore, most states in the northwest region have simple permit systems for gross vehicle weights up to 105,500 pounds, presuming the federal bridge formula is satisfied and axle load and tire load requirements are met. All the states in the region consider the magnitude of the overload and/or the distance traveled in arriving at a permit fee. The present fee schedules in Montana and Utah are perhaps the least costly and least complicated to administer, involving assessments based on broad categories of gross overload and/or distance traveled. Wyoming, conversely, checks both gross overweight and axle overweight in assessing permit fees. The controlling overweight of these two values is then used in calculating a fee based on the magnitude of the overload and the distance traveled. Slightly different fees are assessed for travel on interstate and primary highways. In Wyoming, an upper limit of $200 is set on fees.

Table 3. Salient features of fee practices used in neighboring states for non-divisible overweight loads (developed from fee information directly provided by each state).

State	Weight Limits			Basis for Overweight Fee					
	GVW A B	Axle							
		Load	Spacing	Flat Admin.	Axle Wgt.	GVW	Mileage	Max. Fee	Charge, Engrg. Analysis
Montana	** 80	X*	X*				X	$50	X
Idaho	105.5 80	X*	X*	X		X	X		$100
Oregon	105.5 80	X*	X*	X	X	X	X		
Washington	105.5 80	X*	X*			X	X		X
Wyoming	117 117	X***	X***		X	X	X	$200	
Utah	129 80	X*	X*			X	X	$50	
South Dakota	155.5 80	X*	X*	X		X	X	$100?	
North Dakota	105.5 80	X***	X***	X		X			$15

A - Max. Gross Vehicle Wgt., with simple permit
B - Max. Gross Vehicle Wgt., no permit
* Federal Bridge Formula
** No Apparent Maximum
*** Federal Bridge or Other Formula

In considering the regional trends that exist, it is necessary to address the need for at least regional cooperation to simplify transporting non-divisible loads throughout the Northwest. Section 61-10-1101 of the M.C.A. specifically addresses these points. Article V states that a need exists for standard limits throughout the region. This item has been, for the most part, accomplished indirectly by the fact that all participating states are required to follow federal guidelines in order to obtain federal funding for their particular road system. Uniformity of fees, however, still needs to be addressed. At this time, there does not seem to be any kind of consensus as to what approach should be used in assessing fees, i.e., either axle weight or gross vehicle, or as to what these fees should be.

RECOMMENDATIONS: MONTANA OVERWEIGHT FEE SCHEDULE

General Remarks

A fee schedule for non-divisible overweight loads should:

1) compensate the state for the extraordinary damage inflicted on the pavement by the overload, by fairly assessing a fee on the user,
2) compensate the state for the cost of administering the fee program,
3) be simple to use, thus minimizing errors and inconvenience to the user, and
4) be consistent, as is reasonable, with current practice in other states.

These criteria were assigned approximately equal importance in developing the fee schedule proposed herein.

The new schedule proposed herein considers only axle load (as opposed to gross vehicle weight) in assessing pavement damage related fees. Damage calculations are based on the ESAL to axle load relationships developed from the AASHO Road Tests. This simple approach was adopted for several reasons based on the pavement damage issues previously discussed and the criteria listed above. Axle weight is clearly the most influential of the several parameters that affect pavement damage, and the relationship between axle load and pavement damage has been more thoroughly studied than the relationships between other sets of parameters, such as tire configuration and pavement damage. Some of these other parameters that influence pavement damage can simply be controlled using provisions already contained in the present overweight statutes. Notably, issues related to tire configuration and inflation pressure can be adequately addressed simply by enforcing existing statutory limits on these parameters. It may be possible in the future to more rigorously address these issues using a comprehensive damage model that includes these parameters as variables in the calculation of ESALs for an axle.

In implementing the axle load fee schedule, only a single pavement type was considered in arriving at relative damage factors for various axle loads. In reality, each different pavement configuration (delineated by type and thickness of running surface, base, subgrade, subgrade conditions, etc.) has a unique set of ESAL factors. Generally, in Montana, several pavement configurations will be encountered along the length of any particular highway (MDOH, 1989). Thus, the damageability of a given vehicle, expressed in ESALs, will vary as the vehicle travels along the highway. The total damage inflicted by a particular vehicle across its entire route should then be calculated as the sum of the damage inflicted on each segment of different pavement it traverses. Calculation of total damage in this fashion would be a tedious operation without the aid of a computer. Thus, to simplify fee calculation, a single set of damage factors for an "average" pavement

was assumed for all pavement configurations. Note that if the permit operation is computerized, it may be possible to easily (a) obtain the particular pavements to be traversed by an overweight vehicle (from a road log database), (b) apply the appropriate damage factor relationships for each pavement, and (c) calculate the total pavement damage as the sum of damage for each pavement type.

Schedule

The proposed fee schedule for overweight vehicle traffic in Montana involves both administrative and pavement damage charges. The administrative charge is a flat fee of $10.00. This charge is assessed if (a) any axle on the vehicle is overweight, (b) the gross vehicle weight exceeds 80,000 pounds, or (c) the bridge formula is violated. The pavement damage charge is based on axle loads rather then gross vehicle weight, as axle and axle group loads are more directly related to the accumulation of damage then simple gross vehicle weight. The amount of this charge is related to the magnitude of the overload on each axle or axle group and the distance traveled. This schedule should encourage users to properly weight vehicle axles to minimize pavement damage. Such an incentive is somewhat lacking in schedules based simply on gross vehicle weight. The proposed schedule also includes maximum allowable axle loads for overweight situations. These loads, established to prevent catastrophic pavement damage due to the passage of a single vehicle, will only be exceeded after engineering analyses. With the exception of the aforementioned points, the remaining provisions in the existing statutes that govern overweight vehicle travel will be unchanged. Notably, the maximum gross weight vehicle formula and the allowable vehicle tire loads presented in Section 61-10-107 of the M.C.A. remain in effect. Specific changes to the M.C.A. required to implement this fee schedule are presented in Appendix A.

Following the proposed schedule, each axle group is weighed. The gross vehicle weight is then determined by summing the individual axle weights and/or by direct measurement. The axle weights and gross vehicle weight are then compared with the corresponding allowable unpermitted weights. These unpermitted weights will remain the same as in the current overweight vehicle regulations. If any allowable weight (individual axle or gross vehicle) is exceeded, the user will pay at least a $ 10.00 administration fee. If any of the axle weights exceeds the absolute maximum permitted load, as listed in Table 4 and further discussed below, the user will be denied a permit pending a satisfactory engineering analysis of the situation (to be paid for by the user). The vehicle weight and axle configuration must also be checked with respect to bridge safety, using the same procedures currently employed.

Table 4. Axle load limits, proposed fee schedule.

Axle Configuration	Maximum Unpermitted Load (lbs)	Maximum Permitted Load (lbs)
Single	20,000	32,000
Tandem	34,000	60,000
Tridem	50,000	84,000

Additional pavement damage fees will be assessed for each axle or axle group based on any excess load carried by the axle (or axle group) above unpermitted limits. This excess load will be expressed in terms of excess ESALs. An excess ESAL chart for single, tandem, and tridem axles loaded above maximum unpermitted levels of 20,000; 34,000; and 50,000 pounds, respectively, is presented in Table 5. The excess ESALS for all the axles comprising the vehicle will be summed up and multiplied by a cost factor expressed in terms of cost/ESAL/mile. This cost factor was calculated at $0.16/ESAL/mile. Fee schedules of this type have been proposed for Alaska and Texas in somewhat modified forms (Connor, 1980; Middleton, et.al., 1988; respectively), and Terrell and Bell (1987) convincingly advocate that all states should adopt damage based fee schedules of this form.

The excess ESAL chart presented in Table 5 was obtained by subtracting the absolute ESAL value for each type of axle load at the maximum unpermitted limit from the actual ESAL value for the axle loaded at higher levels. The basic ESAL values for a given axle load vary with pavement type and terminal serviceability index, as previously discussed. In Montana, with a wide variation in pavement configurations and conditions, the ESAL relationship for an "average" flexible pavement with a structural number (SN) of 3.0 and a serviceability index (Pt) of 2.5, was selected as the basis for the overweight fee schedule. This ESAL relationship was previously presented in Figure 2. A structural number (SN) of 3.0 is a reasonable average representation of highway configurations in Montana based on limited inspection of MDOH road logs (MDOH, 1989). Serviceability indexes (Pt) of 2.0 and 2.5, for primary and interstate highways, respectively, are indicative of a pavement in immediate need of repair (TRB, 1990b). Review of the Montana Road Log (MDOH, 1989) clearly indicated that a majority of Montana Highways are constructed with flexible rather than rigid pavement. Nonetheless, the ESAL to axle load relationship for an "average" rigid pavement (8 inch thickness, Pt=2.5) is compared to that of an "average" flexible pavement in Figure 7. As previously noted, the flexible pavement relationship will generally yield lower damage factors for a given load than would be obtained using the rigid pavement relationship in axle overweight situations.

Table 5. Excess ESAL chart to be used in calculating permit fees following the schedule proposed herein.

Axle Damage Factors (in ESALS)					
Single Axle		Tandem		Tridem	
Load (Pounds)	Excess Damage Factor	Load (Pounds)	Excess Damage Factor	Load (Pounds)	Excess Damage Factor
00000 - 20999	0.00	00000 - 34999	0.00	00000 - 50999	0.00
21000 - 21999	0.31	35000 - 35999	0.13	51000 - 51999	0.10
22000 - 22999	0.68	36000 - 36999	0.27	52000 - 52999	0.20
23000 - 23999	1.10	37000 - 37999	0.42	53000 - 53999	0.31
24000 - 24999	1.60	38000 - 38999	0.58	54000 - 54999	0.42
25000 - 25999	2.16	39000 - 39999	0.76	55000 - 55999	0.54
26000 - 26999	2.82	40000 - 40999	0.95	56000 - 56999	0.66
27000 - 27999	3.57	41000 - 41999	1.16	57000 - 57999	0.79
28000 - 28999	4.41	42000 - 42999	1.38	58000 - 58999	0.93
29000 - 29999	5.34	43000 - 43999	1.62	59000 - 59999	1.08
30000 - 30999	6.41	44000 - 44999	1.88	60000 - 60999	1.24
31000 - 31999	7.63	45000 - 45999	2.16	61000 - 61999	1.41
		46000 - 46999	2.47	62000 - 62999	1.58
		47000 - 47999	2.79	63000 - 63999	1.76
		48000 - 48999	3.14	64000 - 64999	1.95
		49000 - 49999	3.51	65000 - 65999	2.15
		50000 - 50999	3.92	66000 - 66999	2.37
		51000 - 51999	4.35	67000 - 67999	2.59
		52000 - 52999	4.82	68000 - 68999	2.82
		53000 - 53999	5.31	69000 - 69999	3.07
		54000 - 54999	5.84	70000 - 70999	3.33
		55000 - 55999	6.40	71000 - 71999	3.60
		56000 - 56999	6.99	72000 - 72999	3.89
		57000 - 57999	7.61	73000 - 73999	4.19
		58000 - 58999	8.29	74000 - 74999	4.50
		59000 - 59999	9.01	75000 - 75999	4.83
				76000 - 76999	5.17
				77000 - 77999	5.52
				78000 - 78999	5.90
				79000 - 79999	6.30
				80000 - 80999	6.71
				81000 - 81999	7.12
				82000 - 82999	7.56
				83000 - 83999	8.05

The maximum unpermitted axle loads currently mandated in Montana are 20,000 and 34,000 pounds on single and tandem axles, respectively (Section 61-10-107, M.C.A., 1989). Presently, there is no specific weight limit on tridem axles, however, an unpermitted limit of 50,000 pounds is reasonable, based on the limit in several other states as reported by Middleton, Villarreal, and Blaschke (1988). Referring to Figure 2, the ESALs for these maximum permitted axle loads on single, tandem, and tridem axles are then 1.49, 1.11, and 1.24, respectively. These values were subtracted from the absolute ESAL values for various axle weights to obtain the EXCESS ESAL values reported in chart form in Table 5. Thus, for example, a tandem axle with a load of 44,000 pounds has an absolute ESAL value of 2.99, as read from Figure 2. The excess ESALs associated with this axle load are equal to the absolute ESAL value minus the maximum unpermitted ESAL value, or 1.88 (2.99-1.11). This value of 1.88 could also be directly read in Table 5 for a tandem axle load of 44,000 pounds.

Single passage of sufficiently high axle loads could result in a dramatic decrease in subsequent pavement life, as previously discussed. Thus, maximum axle loads have been set to preclude this occurrence at load levels of 32,000; 60,000; and 84,000 lbs; for single axles, tandems, and tridems, respectively. These axle loads, as previously discussed, all correspond to an ESAL factor of approximately 10. Connors (1980) recommended any permit with excess ESALs of 6 or more be reviewed by engineers. A Texas study implied that if the total ESALs for all axles of a vehicle exceeded 8.2, special consideration was necessary (Middleton, Villarreal, and Blaschke, 1988).

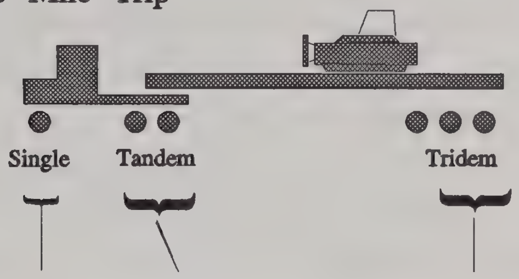
A representative pavement cost per ESAL per mile was calculated using average highway reconstruction and overlay costs divided by their attendant expected ESAL life. This value was then adjusted to account for traffic versus environmental/aging related costs. Following this approach, a value of $0.16 per ESAL per mile was obtained (see Section on Cost Analyses).

Examples

The use and cost impact of the fee schedule proposed herein can be illustrated through examples. Ten typical permits issued for overweight vehicles (single trip, non-divisible load) were obtained from MDOH for this purpose (see Appendix B). Each permit indicated, among other things, the configuration of the axles comprising the vehicle, the load on each axle (or axle group), the approximate distance to be traveled, and the overweight fee assessed using the present schedule. The overweight fee that would be assessed using the schedule proposed herein was calculated in each case using the information on the permit. An example calculation, for a composite vehicle representative of overweight situations, is presented in Figure 8. In this case, the permit fee of $95 is primarily associated with the heavy load on the tandem axle. This charge could possibly be reduced

FEE CALCULATION
for a
TYPICAL OVERWEIGHT TRUCK
LOADED AT 114.5 k (114500 lbs)

150 Mile Trip



LOADS	12 k	48.5 k	54 k
AXLE DAMAGE FACTORS	0.00	3.14	0.42

from Table 5, based on load and axle type

TOTAL DAMAGE FACTOR FOR THIS VEHICLE = 0.00 + 3.14 + 0.42 = 3.56

Exceeds maximum axle loads? No, OK to issue permit

FEE CALCULATION

Exceeds axle and/or gross vehicle limit? Yes	$ 10
Total Damage Factor x Unit Cost/Mile x Miles	
3.56 x $0.16 x 150 miles = $85	85
Total Fee	$ 95

Figure 8. Example calculation of a permit fee following the proposed fee schedule.

by shifting the load toward the rear of the vehicle. Note that the permit fee under the existing schedule would only be $30.00. The fees calculated for all 10 vehicles are reported in Table 6 with the fee charged (for the overload) under the existing schedule.

Referring to Table 6, while the net fees charged using the new schedule are higher than those from the existing schedule, some individual fees are lower. In such cases, the overweight is distributed on the axles in a manner that results in limited excess pavement damage, and the permit fees are low. Note that the average fee increase using the new schedule is $13 or 53 percent, and that the absolute maximum fee among this sample is $103. Note that these conclusions are based on a very small sample of overweight permits (10 out of the 23,000 permits issued annually). Particular categories of overweight traffic may experience larger increases in permit fees. A sampling of 26 overweight trips initiating at the state border and generally involving travel distances in excess of 100 miles produced an average increase in permit fees of $63 or 118 percent and a maximum fee of $399.

Table 6. Comparison of typical permit fees charged using the existing schedule and the new schedule proposed herein.

Permit No.	Total Excess ESALs	Distance Travelled (Miles)	Overweight Fee, New Schedule (Dollars)	Overweight Fee, Existing Schedule (Dollars)	Fee Change (New/Old) - 1	Fee Change (New-Old) (Dollars)
113646	3.93	97	71	40	0.78	31
113647	2.89	309	153	50	2.06	103
789403	2.89	27	22	10	1.20	12
789409	1.16	91	27	10	1.70	17
155104	0.00	144	10	30	-0.67	-20
155105	0.00	143	10	30	-0.67	-20
155106	0.10	58	11	10	0.10	1
155107	0.68	25	13	10	0.30	3
155109	0.42	20	11	10	0.10	1
155110	2.37	10	14	10	0.40	4
Total	-	-	342	210	-	132
Average	-	-	34	21	0.53	13

Comparisons with Other States

The overweight fees that would be charged for travel of the composite truck shown in Figure 8 in several neighboring states were calculated and are listed in Table 7. The fee in Montana of $95, charged under the proposed schedule, is similar to the fees in Washington and Wyoming. Note that the composite truck would not be routinely allowed to operate even with a permit in the states of Washington, Oregon, and North Dakota. The tandem load of 48,500 pounds exceeds the maximum permitted tandem load allowed in these states. The axle configuration would have to be changed before the load could be moved in these states.

Table 7. Comparison of typical permit fees charged in neighboring states with those charged in Montana under the existing and proposed fee schedules.

State	Permit Fee* (Dollars)
Montana (existing schedule)	30
Montana (proposed schedule)	95
Idaho	20
Oregon	****64
Washington	***114
Wyoming	92
Utah	50
South Dakota	57
North Dakota	**33

Example - typical truck described in Figure 8, traveling 150 miles on primary/secondary highways

*Permit Fee does not include any cost of engineering analyses

**tandem axle load exceeds maximum allowable permit load of 42,000 lbs

***tandem axle load exceeds maximum allowable permit load of 43,000 lbs

****tandem axle load exceeds maximum allowable permit load of 48,000 lbs

Montana Penalties

The penalties that would be assessed for unpermitted operation of the ten overweight vehicles considered herein is presented in Table 8. The penalties all significantly exceed the cost of the new

permit. Presuming the axles in the example vehicle of Figure 8 were all loaded to the maximum allowable permit loads, a fee of $603 would be charged using the new schedule, versus a fine of $2000 for operating without a permit (under the current penalty schedule). Thus, in this relatively extreme situation, the permit fee is significantly below the fine for operating without a permit.

Table 8. Comparison of typical permit fees charged using the fee schedule proposed herein with the existing penalties that would be assessed for operating without a permit.

Permit No.	Permit Fee, Proposed Schedule (Dollars)	Penalty for Operating Without a Permit, Existing Schedule* (Dollars)
113646	71	2000
113647	153	2000
789403	22	2000
789409	27	160
155104	10	2000
155105	10	2000
155106	11	2000
155107	13	220
155109	11	2000
155110	14	2000

*Fine is based on either gross or axle overweight, whichever is larger

SUMMARY

Summary and Concluding Remarks

A simple graduated fee schedule is proposed herein for single trip movement of overweight non-divisible loads on Montana highways. The schedule includes a flat fee to recover the cost of administering the fee program and a graduated fee to compensate the state for the excess (unanticipated) damage inflicted on the pavement by such traffic. (This schedule does not address any extraordinary damage inflicted on bridges by overweight vehicles.) The graduated portion of the fee is based on a net excess damage factor for the vehicle, which is determined from the load on each overweight axle comprising the vehicle. This part of the fee is calculated as the product of the net excess damage factor for the vehicle, the distance to be traveled, and a unit damage cost per mile. This schedule is proposed as a replacement for the present schedule that simply assesses flat fees (maximum of $50) for broad categories of distance traveled, without regard for the magnitude of the overweight and level of damage inflicted on the pavement. Maximum axle loads have also been recommended in the new schedule that will not be exceeded even in overweight situations. These loads have been established to prevent possible dramatic decreases in pavement life due to the passage of a single overload.

Obvious advantages of the proposed schedule over the existing system include that (a) the cost of the overweight damage is recovered and (b) overweight vehicle operators are encouraged to properly distribute their loads across the vehicle axles to minimize pavement damage by the potential reward of lower permit fees. Example calculations using typical overweight situations indicate that the net permit fees will increase using the new schedule, while fees for individual vehicles may decrease, if the loads are positioned and supported on the vehicle's axles so that pavement damage is minimized. While the form of the new schedule is not inconsistent with current practice in neighboring states, the assessed fees may exceed those charged in these states. The fees assessed using the new schedule are generally compatible with the fines that would be levied under the present system for unpermitted operation. Generally, the new permit fees are considerably lower than the existing fine schedule.

The form of the damage related contribution to the overweight vehicle permit fee was determined after a study of the various factors that influence pavement damage (which was defined as the general deterioration in the serviceability of the pavement with use). This study revealed that pavement damage is affected by factors related to both the vehicle and the pavement. Factors of interest with respect to the vehicle included the axle loads, axle configurations, tire types, and tire pressures. Pavement related characteristics of interest included type, thickness, temperature,

subgrade, and present condition. Of all these factors, axle load and type overwhelming influence pavement damage, and use of this single factor in assessing the potential damageability of a vehicle was judged technically sufficient and practically desirable for the purpose of devising a simple, equitable fee schedule. Note that the proposed fee schedule may have to be modified to accomodate special circumstances in which the damaging effects of large axle loads are mitigated by other factors. Special consideration may be required, for example, for heavy equipment with wide, large diameter tires that minimize tire-to-pavement contact pressures.

Following the schedule proposed herein, the net excess damage factor for an overweight vehicle is calculated as the sum of the excess damage factors for each axle or axle group. The excess damage for each axle is defined as the difference between the damage inflicted by the overweight axle and the damage that would be inflicted by an identical axle loaded at the maximum unpermitted limit. In both cases, the damage potential of the axle is determined using the damage to axle load relationships established from the results of the AASHO road tests. In these relationships, damage is quantified in terms of ESALs, or the number of passages of a single 18,000 pound axle required to inflict the same damage as a single passage of the axle in question. A single set of ESAL to axle load relationships was selected for use, representative of average pavement conditions in Montana. Thus, the excess damage factor for each axle is expressed as excess ESALs. The maximum unpermitted axle loads used in establishing excess values are 20,000; 34,000; and 50,000 pounds, respectively, for single, tandem, and tridem axles.

The net damage factor for an overweight vehicle is multiplied by a unit damage cost and the distance traveled to obtain the damage related portion of the permit fee. This unit damage cost was simply estimated as the ratio of the average cost of pavement rehabilitation projects to the average expected life of these projects expressed in ESALs (modified to account for vehicular versus environmental/aging damage). Following this approach, a cost of $0.16 per ESAL per mile was determined as appropriate for use in this schedule.

Maximum axle loads were established that will not be exceeded under any circumstances (without special review by authorized transportation officials) to preclude a possible significant decrease in subsequent pavement life due to the single passage of a sufficiently overweight axle. These limits were set at 32,000; 60,000; and 84,000 pounds for single axles, tandems, and tridems, respectively.

Note that the proposed schedule only addresses the damage related to common axle configurations, namely, single axles, tandems, and tridems. Provisions may have to be developed for other axle configurations (such as quadrums), if their use becomes prevalent.

Recommendations

The performance of the fee schedule proposed herein could possibly be improved by considering in the formulation more of the factors that influence pavement damagebility than simply axle load and type. Performance in this context denotes the ability of the schedule to fully recover pavement damage costs from the parties directly responsible for inflicting the damage. The schedule proposed herein, for example, fails to explicitly recognize the beneficial effect of using wide tires rather than narrow tires on an axle. The vehicle that inflicts less damage on the pavement by using wide tires is assessed the same pavement damage fee as the vehicle equipped with narrow tires that inflict substantially more damage on the pavement. Inclusion of additional factors in the damage formulation could also could allow for greater flexibility (e.g., choice in axle spacings, tire width, tire pressure, etc.) in moving non-divisible overweight loads and still insure that the state is adequately compensated for excess damage inflicted by these loads. Additional parameters could by included by using a mathematical expression similar to the comprehensive damage models previously introduced. In some cases, uncertainties in the various coefficients required for each parameter might offset the apparent increased refinement in the damage calculations. In any event, the excess damage associated with each axle would still be calculated as the difference between the absolute damage inflicted by the axle and the damage sustained for the same axle loaded at the maximum unpermitted load.

The fee schedule proposed herein could also be refined by incrementally determining the fee for each different type of pavement to be traversed by the load. As previously commented, the relationship between axle load and pavement damage is influenced by pavement type. The unit cost of pavement damage could also reasonably vary with pavement type. Use of an incremental fee calculation along the route of the vehicle would allow both these factors to be considered.

The modifications suggested above would result in a cumbersome fee calculation unless the process is computerized. The types of pavement used on the various highways across the state could (and may already) be stored in a computer database. This database could be supplemented with the damage relationships appropriate for each pavement type. Permit fees could then be calculated by entering into a program that accessed these databases. Program input might include the origin and destination of the overweight vehicle, the route numbers to be traveled, the weight and type of each axle, and other parameters (e.g. tire widths) as appropriate. Output would consist of the total overweight fee with a breakdown of per axle costs and recommendations for possible weight redistribution that would reduce the fee. Data entry could be facilitated by directly connecting the scale to the computer. Direct feed sensors could also possibly be installed to automatically determine the axle type (e.g., single, tandem, tridem) and measure the tire widths.

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APPENDIX A

DRAFT LEGISLATION FOR MONTANA, NON-DIVISIBLE OVERWEIGHT LOADS

Presented in this appendix are specific modifications to Section 61 of the M.C.A recommended to implement the overweight non-divisible load fee schedule proposed herein.

Add to 61-10-107, following the first sentence

> No three consecutive axles each spaced more than 40 inches but less than 96 inches apart (tridem) may carry a load in excess of 50,000 pounds. Furthermore, the maximum permitted load on single, tandem, and tridem axles will not exceed 32,000; 60,000; and 84,000 pounds, respectively, without the special permission of transportation officials.

Replace 61-10-125 with the following statement:

> **61-10-125. Other fees.** (1) In addition to a basic permit fee of $10, there will be charged a fee determined by the formula:
>
> $$\text{Fee} = DCM$$
>
> in which D is the excess damage factor for the vehicle, calculated as the sum of the damage factors obtained from 61-10-125(2) for each axle group comprising the vehicle; C is a unit excess damage cost of $0.16; and M is the distance to be traveled in miles.
>
> (2) Excess damage factors for overloads on single axles, tandems, and tridems are set forth in the following table:

APPENDIX B

TYPICAL OVERWEIGHT PERMITS, EXISTING FEE SCHEDULE

Presented in this appendix are ten typical overweight fee permits issued by the State of Montana for single trip travel of overweight non-divisible loads.

M 12 Rev 3 89

STATE OF MONTANA DEPARTMENT OF HIGHWAYS

GROSS VEHICLE WEIGHT DIVISION - P.O. BOX 4639
Helena, Montana 59604
Phone: (A.C. 406) 444-6130

11364

APPLICATION AND PERMIT

Permittee Name Mitchell Brothers — Date Issued 10 01 90
Address Box 736 — Time Issued 4:20 A[✓ P]
City Glendive State Mt — Date Expires 10/04/90
ICC No. or Ins. Co. Continental Ins Co — PSC No.
Ser. No. (power) 20723 Make 1978 White Type Tractor Lic. No. 16T-D429 State Mt
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Load (describe): TS14 Scraper — Hwy. Nos. Mt 16; county, US 2
From Glendive Via Same To Havre — Total T.T.P. Miles 200 +
Maximum Permitted: Width L Ft. In; Length L Ft. In; Height L Ft. In.

THIS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO. 129326

☐ Limits Form 32F ☐ Vehicle Analysis No. 90-1960 or indicate axle configuration and weight.

10,000 lbs.	47,640 lbs.	lbs.	51,750 lbs.	lbs.
Stg.	Drive	Jeep or Pup	Trailer	~~Booster or Pup~~
○	○ ○ ☒	○ ○ ○	○ ○ ○	○ ○ ☒

PERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED NUMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

- Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
- 55 m.p.h. loads over 10′ wide and long combination vehicles unless otherwise indicated, or posted.
- Trip permits valid for 72 hours. VOID on leaving state.
- Permits shall be carried in vehicle at all times and are void if altered.
- A County or City permit may be required in addition to this permit for travel on county roads or city streets.
- Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
- Permit void upon expiration of Reg. and/or G.V.W. fees for year in which permit is issued.
- Permittee is responsible to determine clearance of structures.

See attached

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit	$20.00	☐
Temporary Fuel Permit	$30.00	☐
Temporary Truck Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Restricted Route Load Permit	$	☐
Special Vehicle Comb	$	☐
100′ Vehicle Comb (Term)	$ 125.00	☐
Special Permit Fee (Trip)	$10.00	☐
Special Permit Fee (Term)	$75.00	☐
Weight Mileage (100 miles incl.)	$10.00	☐
Weight Mileage (101-199 miles incl.)	$30.00	☐
Weight Mileage (200 miles and over)	$50.00	☒
Special Permit Fee (5% or 7% First Scale)	$10.00	☐
PSC Temporary Stamp Permit	$30.00	☐
VOID ENTIRE PERMIT		☐

Total Collected $ 50.00
D.O.H. By V Remple No. 407
Helena Approval By

Permittee agrees to comply with all laws and regulations, to take all reasonable safety precautions and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit, the permittee agrees to indemnify the Department for all damages to highways and structures caused by the movement of the permitted vehicle

Permittee By: George Mitchell

HELENA USE ONLY
Collect State Fee $ Date
Sent to:
☐ [illegible] ☐ CCIS ☐ Other

RM 32 Rev 3 89

STATE OF MONTANA DEPARTMENT OF HIGHWAYS

GROSS VEHICLE WEIGHT DIVISION - P. O. BOX 4639
Helena, Montana 59604
Phone: (A.C. 406) 444-6130

1135

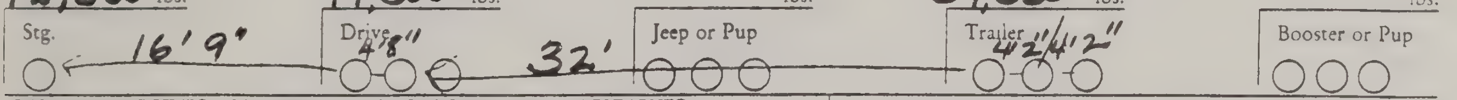
APPLICATION AND PERMIT

Permittee Name Burlington Northern — Date Issued 10 1 90
Address 801 Main Ave — Time Issued 3:00 [✓ PM]
City Fargo — State ND — Date Expires 10 4 90
ICC No. or Ins. Co. Adequate — PSC No.
Ser. No. (power) X6LD302060 — Make Peterbilt — Type Truck — Lic. No. 14000 — State ND.
Unit or Ser. No. (trlr.) — Make — Type — Lic. No. — State
Unit or Ser. No. (trlr.) — Make — Type — Lic. No. — State
Unit or Ser. No. (trlr.) — Make — Type — Lic. No. — State
Load (describe): Terex Scraper — Hwy. Nos. I-94
From 10mi E of MC — Via Same — To Big Horn — Total T.T.P. Miles 100-200
Maximum Permitted: Width ✓ Ft. In; Length ✓ Ft. In; Height ✓ Ft. In.

THIS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO.

☐ Limits Form 32F ☐ Vehicle Analysis No. or indicate axle configuration and weight.

12,000 lbs. 49,300 lbs. lbs. 54,330 lbs. lbs.



PERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED NUMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

- Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
- 55 m.p.h. loads over 10' wide and long combination vehicles unless otherwise indicated, or posted.
- Trip permits valid for 72 hours. VOID on leaving state.
- Permits shall be carried in vehicle at all times and are void if altered.
- A County or City permit may be required in addition to this permit for travel on county roads or city streets.
- Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
- Permit void upon expiration of Reg. and / or G.V.W. fees for year in which permit is issued.
- Permittee is responsible to determine clearance of structures.

See attached

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit	$20.00	☐
Temporary Fuel Permit	$30.00	☐
Temporary Truck Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Restricted Route Load Permit	$	☐
Special Vehicle Comb	$	☐
100' Vehicle Comb (Term)	$ 125.00	☐
Special Permit Fee (Trip)	$10.00	☒
Special Permit Fee (Term)	$75.00	☐
Weight Mileage (100 miles incl.)	$10.00	☐
Weight Mileage (101-199 miles incl.)	$30.00	☒
Weight Mileage (200 miles and over)	$50.00	☐
Special Permit Fee (5% or 7% First Scale)	$10.00	☐
PSC Temporary Stamp Permit	$30.00	☐
VOID ENTIRE PERMIT		☐

Total Collected $ 40.00
D.O.H. By V. Temple No. 407
Helena Approval By

Permittee agrees to comply with all laws and regulations, to take all reasonable safety precautions, and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit, the permittee agrees to indemnify the Department for all damages to highways and structures caused by the movement of the permitted vehicle.

Permittee By: Ron West

HELENA USE ONLY
Collect State Fee $ — Date
Sent to:
☐ Transceiver; ☐ CCIS; ☐ Other

FORM 32-Rev 5/88

STATE OF MONTANA DEPARTMENT OF HIGHWAYS

GROSS VEHICLE WEIGHT DIVISION-P.O. BOX 4639
Helena, Montana 59604
Phone: (A.C. 406) 444-6130

789403

APPLICATION AND PERMIT

Permittee Name Hunters Bros
Address
City Butte State MT
ICC No. or Ins. Co.
Date Issued 9 27 90
Time Issued A P
Date Expires
PSC No

Ser. No. (power) 10076 Make 67K20 Type TK Lic. No 1T27773 State MT
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Load (describe): Excavator Hwy. Nos. MT 1, I 90
From Anaconda Via I-90 MT 1 To Butte Total T.T.P. Miles
Maximum Permitted: Width Ft. In; Length Ft. In; Height Ft. In

THIS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO. 789325

☐ Limits Form 32F ☐ Vehicle Analysis No. or indicate axle configuration and weight.

10 000 lbs.	47, 640 lbs.	lbs.	51,750 lbs.	lbs
Stg.	Drive	~~Jeep or Pup~~	Trailer	~~Booster or Pup~~
○	○ ○	○ ○	○ ○ ○	○ ○

PERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED NUMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

- Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
- 55 m.p.h. loads over 10′ wide unless otherwise indicated, or posted.
- Trip Permits valid for 72 hours. VOID on leaving state.
- Permits shall be carried in vehicle at all times and are void if altered.
- A County or City permit may be required in addition to this permit for travel on county roads or city streets.
- Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
- Permit void upon expiration of Reg. and/or G.V.W. fees for year in which permit is issued.
- Permittee is responsible to determine clearance of structures.

NUMBERED RESTRICTIONS:

☐ 1. Travel during daylight hours only.
☐ 2. No travel Saturday, Sunday, New Year's, Memorial, Fourth of July, Labor Day, Thanksgiving, Christmas Holidays or Friday preceeding if Holiday is on Saturday, or Monday if Holiday is on Sunday.
☐ 3. No travel after 3:00 pm Friday to sunrise Monday on routes listed on red route restrictions map. Hwy nos:
☐ 4. Flag vehicles required front and rear on two-lane, rear on interstate if load exceeds width of travel lane from centerline to continuous shoulder line or edge of paved surface, whichever is lesser.
☐ 5. Flag vehicle required rear on two-lane, over 100′ long, rear on interstate over 110′ long.
☐ 6. Travel during hours of darkness provided full width and length of load is lighted. Maximum 9′ wide, or 75′ long, or 14′6″ high.
☐ 7. Speed not to exceed 5 mph over structures.
☐ 8. Speed not to exceed 55 mph on interstate, 45 mph on two-lane. Two flag vehicles required at the rear on interstate, one front and one rear flag vehicle on two-lane to clear structure of all traffic. Load to cross centerline of structure at 5 mph.
☐ 9. Issued per 61-10-144, MCA (5% or 7% First Scale). Sections 15-70-312 61-10-101 through 233, MCA.
☐ 10. Other restrictions:

HELENA USE
Collect State Fee $ Date
Sent to:

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit	$20.00	☐
Temporary Fuel Permit	$30.00	☐
Temporary Truck Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Restricted Route Load Permit	$	☐
Special Vehicle Comb.	$	☐
Special Permit Fee (Trip)	$10.00	☐
Special Permit Fee (Term)	$75.00	☐
Weight Mileage (100 miles incl.)	$10.00	☒
Weight Mileage (101-199 miles incl.)	$30.00	☐
Weight Mileage (200 miles and over)	$50.00	☐
Special Permit Fee (5% or 7% First Scale)	$10.00	☐
PSC Temporary Stamp Permit	$30.00	☐
VOID ENTIRE PERMIT		☐

TOTAL COLLECTED $ 10.00
Ten & 00/100 Dollars

D.O.H. By R. Atkins No. 403
Helena Approval By

Permittee agrees to comply with all laws and regulations to take all reasonable safety precautions and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit the permittee agrees to indemnify the Department of all damages to highways and structures caused by the movement of the permitted vehicle.

Permittee By Shawn Hunter

[illegible] 32 Rev. [illegible] 88

STATE OF MONTANA DEPARTMENT OF HIGHWAYS

GROSS VEHICLE WEIGHT DIVISION-P O BOX 4639
Helena, Montana 59604
Phone: (A.C. 406) 444-6130

789409

APPLICATION AND PERMIT

Permittee Name Bragill Drilling
Date Issued 9 26 90
Address
Time Issued 12:00 A [✓ P]
City Butte State Mt
Date Expires 9/30/90
ICC No. or Ins. Co.
PSC No.
Ser. No. (power) Make 74 Mack Type TK Lic. No. 15-23 State Mt
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Load (describe): Drill Rig Hwy. Nos. I 90-278
From Dillon Via To Elk Horn Total T.T.P. Miles ~100
Maximum Permitted: Width Ft. In; Length Ft. In; Height Ft. In

THIS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO. 129624

☐ Limits Form 32F ☐ Vehicle Analysis No. or indicate axle configuration and weight.

18,000 lbs.	41,000 lbs.	lbs.	lbs.	lbs.
Stg.	Drive	~~Jeep or Pup~~	~~Trailer~~	~~Booster or Pup~~
○	○ ○	○ ○	○ ○ ○	○ ○

PERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED NUMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

- Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
- 55 m.p.h. loads over 10′ wide unless otherwise indicated, or posted.
- Trip Permits valid for 72 hours. VOID on leaving state.
- Permits shall be carried in vehicle at all times and are void if altered.
- A County or City permit may be required in addition to this permit for travel on county roads or city streets.
- Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
- Permit void upon expiration of Reg. and/or G.V.W. fees for year in which permit is issued.
- Permittee is responsible to determine clearance of structures.

NUMBERED RESTRICTIONS:

☐ 1. Travel during daylight hours only.
☐ 2. No travel Saturday, Sunday, New Year's, Memorial, Fourth of July, Labor Day, Thanksgiving, Christmas Holidays or Friday preceeding if Holiday is on Saturday, or Monday if Holiday is on Sunday.
☐ 3. No travel after 3:00 pm Friday to sunrise Monday on routes listed on red route restrictions map. Hwy nos: ____________________
☐ 4. Flag vehicles required front and rear on two-lane, rear on interstate if load exceeds width of travel lane from centerline to continuous shoulder line or edge of paved surface, whichever is lesser.
☐ 5. Flag vehicle required rear on two-lane, over 100′ long, rear on interstate over 110′ long.
☐ 6. Travel during hours of darkness provided full width and length of load is lighted. Maximum 9′ wide, or 75′ long, or 14′6″ high.
☐ 7. Speed not to exceed 5 mph over structures.
☐ 8. Speed not to exceed 55 mph on interstate, 45 mph on two-lane. Two flag vehicles required at the rear on interstate, one front and one rear flag vehicle on two-lane to clear structure of all traffic. Load to cross centerline of structure at 5 mph.
☐ 9. Issued per 61-10-144, MCA (5% or 7% First Scale). Sections 15-70-312 61-10-101 through 233, MCA.
☐ 10. Other restrictions:

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit	$20.00	☐
Temporary Fuel Permit	$30.00	☐
Temporary Truck Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Restricted Route Load Permit	$	☐
Special Vehicle Comb.	$	☐
Special Permit Fee (Trip)	$10.00	☐
Special Permit Fee (Term)	$75.00	☐
Weight Mileage (100 miles incl.)	$10.00	●
Weight Mileage (101-199 miles incl.)	$30.00	☐
Weight Mileage (200 miles and over)	$50.00	☐
Special Permit Fee (5% or 7% First Scale)	$10.00	☐
PSC Temporary Stamp Permit	$30.00	☐
VOID ENTIRE PERMIT		☐

TOTAL COLLECTED $ 10.00
Ten & 00/100 Dollars

D.O.H. By N. Atkins No. 403
Helena Approval By

Permittee agrees to comply with all laws and regulations, to take all reasonable safety precautions and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit the permittee agrees to indemnify the Department for all damages to highways and structures caused by the movement of the permitted vehicle.

Permittee By: Bruce Bragill

HELENA USE ONLY
Collect State Fee $ Date
Sent to:
☐ Transceiver: ☐ CCIS: ☐ Other

155104

GROSS VEHICLE WEIGHT DIVISION - P.O. BOX 4639
Helena, Montana 59604
Phone: (A.C. 406) 444-6130

‚PPLICATION AND PERMIT

ermittee Name Brand S
Date Issued 09 / 27 / 90
ddress
Time Issued [illegible] A.P.
ity Livingston State MT 59047
Date Expires [illegible]/ 02/90
:C No. or Ins. Co.
PSC No.
r. No. (power) 1651365 wb Make '78 KENW Type TK Lic. No. 49T-K378 State MT
nit or Ser. No. (trlr.) Make Type Lic. No. State
nit or Ser. No. (trlr.) Make Type Lic. No. State
nit or Ser. No. (trlr.) Make Type Lic. No. State
oad (describe): D-7 Cat Hwy. Nos. Various Statewide
rom Martinsdale Via To Bridger Total T.T.P. Miles -200
laximum Permitted: Width Ft. In; Length Ft. In; Height Ft. In.

HIS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO. 118231

] Limits Form 32F ☐ Vehicle Analysis No. or indicate axle configuration and weight.

10,000 lbs.	47,500 lbs.	lbs.	48,000 lbs.	lbs.
Stg.	Drive	Jeep or Pup	Trailer	Booster or Pup
○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○

ERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED
IUMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
55 m.p.h. loads over 10' wide and long combination vehicles unless otherwise indicated, or posted.
Trip permits valid for 72 hours. VOID on leaving state.
Permits shall be carried in vehicle at all times and are void if altered.
A County or City permit may be required in addition to this permit for travel on county roads or city streets.
Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
Permit void upon expiration of Reg. and/or G.V.W. fees for year in which permit is issued.
Permittee is responsible to determine clearance of structures.

Not valid without term permit.

ELENA
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NLY

Collect State Fee $ Date
Sent to:
☐ Transceiver; ☐ CCIS; ☐ Other

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit	$20.00	☐
Temporary Fuel Permit	$30.00	☐
Temporary Truck Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Restricted Route Load Permit	$	☐
Special Vehicle Comb	$	☐
100' Vehicle Comb (Term)	$ 125.00	☐
Special Permit Fee (Trip)	$10.00	☐
Special Permit Fee (Term)	$75.00	☐
Weight Mileage (100 miles incl.)	$10.00	☐
Weight Mileage (101-199 miles incl.)	$30.00	
Weight Mileage (200 miles and over)	$50.00	☐
Special Permit Fee (5% or 7% First Scale)	$10.00	☐
PSC Temporary Stamp Permit	$30.00	☐
VOID ENTIRE PERMIT		☐

Total Collected $ 30.00
D.O.H. By Wilma Bogar No. 202
Helena Approval By

Permittee agrees to comply with all laws and regulations, to take all reasonable safety precautions, and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit, the permittee agrees to indemnify the Department for all damages to highways and structures caused by the movement of the permitted vehicle.

Permittee By: Dean Peterson

GROSS VEHICLE WEIGHT DIVISION - P O. BOX 4639
Helena, Montana 59604
Phone: (A.C. 406) 444-6130

1551

PPLICATION AND PERMIT

ermittee Name Brand S — Date Issued 09 / 28 / 9
ddress Box 1119 — Time Issued ______ A.P
ity ~~Livingston~~ — State MT 59047 — Date Expires 10/04/90
C No. or Ins. Co. ~~1651365~~ Wausau Insurance Co — PSC No. ______
r. No. (power) 1651365 — Make '78 Kenw — Type TK — Lic. No. 49T-K378 — State MT
nit or Ser. No. (trlr.) ______ Make ______ Type ______ Lic. No. ______ State ______
nit or Ser. No. (trlr.) ______ Make ______ Type ______ Lic. No. ______ State ______
nit or Ser. No. (trlr.) ______ Make ______ Type ______ Lic. No. ______ State ______
oad (describe): Excavator — Hwy. Nos. Various Statewide
rom Elliston — Via ______ To Livingston — Total T.T.P. Miles -200
aximum Permitted: Width ______ Ft. ______ In; Length ______ Ft. ______ In; Height ______ Ft. ______ In.

IS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO. 118231

] Limits Form 32F ☐ Vehicle Analysis No. ______ or indicate axle configuration and weight.

0,000 lbs.	47,500 lbs.	lbs.	48,000 lbs.	lbs.
Stg.	Drive	Jeep or Pup	Trailer	Booster or Pup
○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○

ERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED NUMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
55 m.p.h. loads over 10' wide and long combination vehicles unless otherwise indicated, or posted.
Trip permits valid for 72 hours. VOID on leaving state.
Permits shall be carried in vehicle at all times and are void if altered.
A County or City permit may be required in addition to this permit for travel on county roads or city streets.
Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
Permit void upon expiration of Reg. and/or G.V.W. fees for year in which permit is issued.
Permittee is responsible to determine clearance of structures.

Permit not valid without term permit.
Permit commences 10/01/90.

ELENA
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Collect State Fee $ ______ Date ______
Sent to: ______
☐ Transceiver; ☐ CCIS; ☐ Other ______

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit . . . . $20.00 ☐
Temporary Fuel Permit . . . . $30.00 ☐
Temporary Truck Permit . . . . . . $ ______ ☐
Temporary Trailer Permit . . . . . $ ______ ☐
Temporary Trailer Permit . . . . . $ ______ ☐
Temporary Trailer Permit . . . . . $ ______ ☐
Restricted Route Load Permit . . . . $ ______ ☐
Special Vehicle Comb . . . . $ ______ ☐
100' Vehicle Comb (Term) . . . . . $ 125.00 ☐
Special Permit Fee (Trip) . . . . $10.00 ☐
Special Permit Fee (Term) . . . . $75.00 ☐
Weight Mileage (100 miles incl.) . . . . $10.00 ☐
Weight Mileage (101-199 miles incl.) . . . . $30.00 ☒
Weight Mileage (200 miles and over) . . . . $50.00 ☐
Special Permit Fee (5% or 7% First Scale) . . . . $10.00 ☐
PSC Temporary Stamp Permit . . . . $30.00 ☐
VOID ENTIRE PERMIT . . . . ☐

Total Collected $ 30.00
D.O.H. By Wilma Bogar — No. 404
Helena Approval By ______

Permittee agrees to comply with all laws and regulations, to take all reasonable safety precautions, and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit, the permittee agrees to indemnify the Department for all damages to highways and structures caused by the movement of the permitted vehicle.

Permittee By: ______

STATE OF MONTANA DEPARTMENT OF HIGHWAYS
GROSS VEHICLE WEIGHT DIVISION - P.O. BOX 4639
Helena, Montana 59604
Phone: (A.C. 406) 444-6130

15510

PPLICATION AND PERMIT

ermittee Name Edsall Construction — Date Issued 10 31
ddress — Time Issued A P
ity Bozeman — State MT 59715 — Date Expires 10/01/90
C No. or Ins. Co. — PSC No.
r. No. (power) — Make — Type crane — Lic. No. SM 6-1 — State MT
nit or Ser. No. (trlr.) — Make — Type — Lic. No. — State
nit or Ser. No. (trlr.) — Make — Type — Lic. No. — State
nit or Ser. No. (trlr.) — Make — Type — Lic. No. — State
oad (describe): Crane — Hwy. Nos. Various Statewide
rom North of Bozeman — Via — To Bozeman Sr High School — Total T.T.P. Miles -100
aximum Permitted: Width ___ Ft. ___ In; Length ___ Ft. ___ In; Height ___ Ft. ___ In.

HIS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO. 106718

Limits Form 32F ☐ Vehicle Analysis No. ___ or indicate axle configuration and weight.

Stg.	Drive	Jeep or Pup	Trailer	Booster or Pup
22,500 lbs.	42,000 lbs.	lbs.	lbs.	lbs.
○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○

ERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED UMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
55 m.p.h. loads over 10' wide and long combination vehicles unless otherwise indicated, or posted.
Trip permits valid for 72 hours. VOID on leaving state.
Permits shall be carried in vehicle at all times and are void if altered.
A County or City permit may be required in addition to this permit for travel on county roads or city streets.
Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
Permit void upon expiration of Reg. and/or G.V.W. fees for year in which permit is issued.
Permittee is responsible to determine clearance of structures.

Not valid without term permit.

~~Travel during daylight hours only.~~

ELENA
SE
NLY

Collect State Fee $ ___ Date ___
Sent to:
☐ Transceiver; ☐ CCIS; ☐ Other ___

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit	$20.00	☐
Temporary Fuel Permit	$30.00	☐
Temporary Truck Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Restricted Route Load Permit	$	☐
Special Vehicle Comb	$	☐
100' Vehicle Comb (Term)	$ 125.00	☐
Special Permit Fee (Trip)	$10.00	☐
Special Permit Fee (Term)	$75.00	☐
Weight Mileage (100 miles incl.)	$10.00	☒
Weight Mileage (101-199 miles incl.)	$30.00	☐
Weight Mileage (200 miles and over)	$50.00	☐
Special Permit Fee (5% or 7% First Scale)	$10.00	☐
PSC Temporary Stamp Permit	$30.00	☐
VOID ENTIRE PERMIT		☐

Total Collected $ 10.00

D.O.H. By Wilma Bogar — No. 404

Helena Approval By

Permittee agrees to comply with all laws and regulations, to take all reasonable safety precautions, and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit, the permittee agrees to indemnify the Department for all damages to highways and structures caused by the movements of the permitted vehicle.

Permittee By:

STATE OF MONTANA DEPARTMENT OF HIGHWAYS
GROSS VEHICLE WEIGHT DIVISION - P.O. BOX 4639
Helena, Montana 59604
Phone: (A.C. 406) 444-6130

155109

.PPLICATION AND PERMIT

ermittee Name Kenyon Noble Ready Mix Date Issued 10 / 02 90
ddress P. O. Box 1387 Time Issued ______ A.P
ity Bozeman State MT 59715 Date Expires 10/05/90
C No. or Ins. Co. Dimarco-Diercks PSC No. ______
r. No (power) 35148 Make '77 Mack Type Trac Lic. No. 6T-31823 State MT
nit or Ser. No. (trlr.) ______ Make ______ Type ______ Lic. No. ______ State ______
nit or Ser. No. (trlr.) ______ Make ______ Type ______ Lic. No. ______ State ______
nit or Ser. No. (trlr.) ______ Make ______ Type ______ Lic. No. ______ State ______
oad (describe): D-8 Cat Hwy. Nos. Various Statewide
rom Gallatin Gateway Via ______ To Big Sky Total T.T.P. Miles -100
laximum Permitted: Width 13 Ft. 00 In; Length ______ Ft. ______ In; Height ______ Ft. ______ In

HIS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO. ______

i Limits Form 32F ☐ Vehicle Analysis No. 90-1902 or indicate axle configuration and weight.

12,000 lbs.	48,820 lbs.	lbs.	wb 54,630 lbs.	lbs.
Stg.	Drive	Jeep or Pup	Trailer	Booster or Pup
○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○

ERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED
NUMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
55 m.p.h. loads over 10' wide and long combination vehicles unless otherwise indicated, or posted.
Trip permits valid for 72 hours. VOID on leaving state.
Permits shall be carried in vehicle at all times and are void if altered.
A County or City permit may be required in addition to this permit for travel on county roads or city streets.
Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
Permit void upon expiration of Reg. and/or G.V.W. fees for year in which permit is issued.
Permittee is responsible to determine clearance of structures.

Permit not valid without attachment.

ELENA Collect State Fee $ ______ Date ______
SE Sent to: ______
NLY ☐ Transceiver; ☐ CCIS; ☐ Other ______

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit	$20.00	☐
Temporary Fuel Permit	$30.00	☐
Temporary Truck Permit	$ ______	☐
Temporary Trailer Permit	$ ______	☐
Temporary Trailer Permit	$ ______	☐
Temporary Trailer Permit	$ ______	☐
Restricted Route Load Permit	$ ______	☐
Special Vehicle Comb	$ ______	☐
100' Vehicle Comb (Term)	$ 125.00	☐
Special Permit Fee (Trip)	$10.00	☒
Special Permit Fee (Term)	$75.00	☐
Weight Mileage (100 miles incl.)	$10.00	☒
Weight Mileage (101-199 miles incl.)	$30.00	☐
Weight Mileage (200 miles and over)	$50.00	☐
Special Permit Fee (5% or 7% First Scale)	$10.00	☐
PSC Temporary Stamp Permit	$30.00	☐
VOID ENTIRE PERMIT		☐

Total Collected $ 20.00
D.O.H. By Wilma Bogar No. 404
Helena Approval By ______

Permittee agrees to comply with all laws and regulations, to take all reasonable safety precautions, and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit, the permittee agrees to indemnify the Department for all damages to highways and structures caused by the movement of the permitted vehicle.

Permittee By:

FORM 32-Rev 8/89

STATE OF MONTANA DEPARTMENT OF HIGHWAYS

GROSS VEHICLE WEIGHT DIVISION - P.O. BOX 4639
Helena, Montana 59604
Phone: (A.O. 406) 444-6130

155110

APPLICATION AND PERMIT

Permittee Name Kenyon Noble
Date Issued 10 03 90
Address
Time Issued 0710 [✓ A] P.
City Bozeman State MT
Date Expires 10/05/90
ICC No. or Ins. Co. Almareo/Diercks
PSC No.
Ser. No. (power) 40535 P Make '71 PBT Type TK Lic. No. 6T-48827 State MT
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Load (describe): D-8. Cat Hwy. Nos. Various
From Sypes Canyon Via To South 3rd Total T.T.P. Miles -100
Maximum Permitted: Width Ft. In; Length Ft. In; Height Ft. In.

THIS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO. 106708

☐ Limits Form 32F ☐ Vehicle Analysis No. 90-1901 or indicate axle configuration and weight.

12,000 lbs.	57,400 lbs.	lbs.	62040 lbs.	lbs.
Stg.	Drive	Jeep or Pup	Trailer	Booster or Pup
○	○○○	○○○	○○○	○○○

PERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED NUMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

- Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
- 55 m.p.h. loads over 10' wide and long combination vehicles unless otherwise indicated, or posted.
- Trip permits valid for 72 hours. VOID on leaving state.
- Permits shall be carried in vehicle at all times and are void if altered.
- A County or City permit may be required in addition to this permit for travel on county roads or city streets.
- Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
- Permit void upon expiration of Reg. and/or G.V.W. fees for year in which permit is issued.
- Permittee is responsible to determine clearance of structures.

Not Valid Without
Attached Sheet

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit	$20.00	☐
Temporary Fuel Permit	$30.00	☐
Temporary Truck Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Restricted Route Load Permit	$	☐
Special Vehicle Comb	$	☐
100' Vehicle Comb (Term)	$ 125.00	☐
Special Permit Fee (Trip)	$10.00	☐
Special Permit Fee (Term)	$75.00	☐
Weight Mileage (100 miles incl.)	$10.00	☒
Weight Mileage (101-199 miles incl.)	$30.00	☐
Weight Mileage (200 miles and over)	$50.00	☐
Special Permit Fee (5% or 7% First Scale)	$10.00	☐
PSC Temporary Stamp Permit	$30.00	☐
VOID ENTIRE PERMIT		☐

Total Collected $ 10.00
D.O.H. By P. Letendre No. 404
Helena Approval By

Permittee agrees to comply with all laws and regulations, to take all reasonable safety precautions, and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit, the permittee agrees to indemnify the Department for all damages to highways and structures caused by the movement of the permitted vehicle.

Permittee By: Gene Marshall

HELENA
Collect State Fee $ Date
Sent to:
☐ Transceiver: ☐ CCIS: ☐ Other

FORM 32-Rev 9/89

STATE OF MONTANA DEPARTMENT OF HIGHWAYS

GROSS VEHICLE WEIGHT DIVISION - P.O. BOX 4639
Helena, Montana 59604
Phone: (A.C. 406) 444-6130

15[illegible]

APPLICATION AND PERMIT

Permittee Name A.M. Welles Date Issued 10 1 90
Address Box 8 Time Issued 0750 A.P.
City Norris State MT Date Expires 10/3/90
ICC No. or Ins. Co. PSC No.
Ser. No. (power) Make '79 Ken Type TR Lic. No 25T-9366 State MT
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Unit or Ser. No. (trlr.) Make Type Lic. No. State
Load (describe): Loader Hwy. Nos. Various state
From Gardiner Via To 5 mi. E. Livingston Total T.T.P. Miles
Maximum Permitted: Width Ft. In; Length Ft. In; Height Ft. In.

THIS PORTION ISSUED FOR EXCESS WEIGHT ONLY PER CONDITION OF TERM PERMIT NO. 798168
☐ Limits Form 32F ☐ Vehicle Analysis No. 89-1874A or indicate axle configuration and weight.

Stg.	Drive	Jeep or Pup	Trailer	Booster or Pup
12,000 lbs.	~~49,960~~ 47,300 lbs. Pd	lbs.	51,900 lbs.	lbs.
○	○○○	○○○	○○○	○○○

PERMIT SUBJECT TO ALL GENERAL CONDITIONS AND ANY PUNCHED NUMBERED AND WRITTEN RESTRICTIONS. GENERAL CONDITIONS:

- Maximum speed 65 m.p.h. unless otherwise indicated, or posted.
- 55 m.p.h. loads over 10' wide and long combination vehicles unless otherwise indicated, or posted.
- Trip permits valid for 72 hours. VOID on leaving state.
- Permits shall be carried in vehicle at all times and are void if altered.
- A County or City permit may be required in addition to this permit for travel on county roads or city streets.
- Restricted Route Load Permits subject to Sec. 61-10-107 MCA.
- Permit void upon expiration of Reg. and/or G.V.W. fees for year in which permit is issued.
- Permittee is responsible to determine clearance of structures.

Not Valid Without
Term Permit.

VALID ONLY FOR THOSE ITEMS PUNCHED

Temporary L.P.G. Permit	$20.00	☐
Temporary Fuel Permit	$30.00	☐
Temporary Truck Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Temporary Trailer Permit	$	☐
Restricted Route Load Permit	$	☐
Special Vehicle Comb	$	☐
100' Vehicle Comb (Term)	$ 125.00	☐
Special Permit Fee (Trip)	$10.00	☐
Special Permit Fee (Term)	$75.00	☐
Weight Mileage (100 miles incl.)	$10.00	☒
Weight Mileage (101-199 miles incl.)	$30.00	☐
Weight Mileage (200 miles and over)	$50.00	☐
Special Permit Fee (5% or 7% First Scale)	$10.00	☐
PSC Temporary Stamp Permit	$30.00	☐
VOID ENTIRE PERMIT		☐

Total Collected $ 10.00
D.O.H. By P. Letendre No. 404
Helena Approval By

Permittee agrees to comply with all laws and regulations, to take all reasonable safety precautions, and to be responsible for all personal and property damages whatsoever. In consideration of being granted this permit, the permittee agrees to indemnify the Department for all damages to highways and structures caused by the movement of the permitted vehicle.

Permittee By: Ken Thompson

HELENA USE: ONLY
Collect State Fee $ Date
Sent to:
☐ [illegible] ☐ CCIS ☐ Other

MDT Library
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